Workshop Manual

911

Carrera 4

Dr. Ing. h.c. F. Porsche Aktiengesellschaft

The workshop manual is only for the internal use of the Porsche Dealer Organization.

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List of Repair Groups Carrera 4

Printed in Germany, 1988

Survey of Information Published in Technical Manual beginning in 1985

6 Cyl. 4

	TI/QI		No.	911 C2/C4	911		911 Turbo	Remarks, Model, Also refer to...	Date
1985									
– Summer Tires 205/55 VR 16 and 225/50 VR 16	T		1/85		●		●	Goodyear/Dunlop	28.02.85
– Brake Booster 8"	Q		1/85		●		●	Turbo Look	15.02.85
– Breake Pressure Regulator	Q		2/85		●			Turbo Look/55bar	15.02.85
– Flat Spotting of Tires	Q		3/85		●		●	4 bar	10.04.85
– Turbo Brake Calipers Front and Rear	Q		4/85		●		●	Turbo/...-Look	10.04.85
– Aluminium Wheel Nuts	Q		5/85		●		●	Special Tool P 300	07.06.85
– Shock Absorber front/rear	Q		6/85		●		●	1985 (F) Model	07.06.85
– Winter Tires and Tire Chains	T		2/85		●		●	Replaced	30.10.85
– Brake Force Regulator	Q		7/85		●			33bar/55bar	29.11.85
– Shock Absorber front/rear	Q		8/85		●		●	1986 (G) Model	29.11.85
1986									
– Brake Lines Visual Inspection On Car	Q		1/86		●		●	Pipe/hose clearance	09.05.86
– Testing Criteria and Measures in Case of Damages on Steering System	T		1/86		●		●	All types	30.07.86
– Winter Tires and Tire Chains	T		2/86		●		●	Replaced	29.10.86
– Whell Installation Installing Procedures	Q		2/86		●		●	Paint dot/wheel bolts	25.11.86
– Wheel Imbalance Balancing on Car	Q		3/86		●		●	Front wheels in "straight ahead" position	25.11.86
– Front / Rear Shock Absorbers	Q		4/86		●		●	1987 (H) Model	25.11.86
1987									
– Wheel Sizes / 7 J and 8 J x 16	Q		1/87		●		●	Wheel clearance	20.02.87
– Replacement Parts Brake Pad Kit	Q		2/87		●		●	Table	31.08.87
– Rear Axle Rear Axle Strut	Q		3/87		●		●	Spacer 2mm	16.10.87
– Wheel Rim Sizes / 7J und 8J x 16	Q	⊕	1/87		●		●	Wheel clearance	16.10.87
– Summer Tires and Wheel Rim Survey	T		1/87		●		●		30.11.87
– Winter Tires and Tire Chains	T		2/87		●		●		30.11.87
– Front / Rear Shock Absorbers Survey - 1988 Models	Q		4/87		●		●	1988 (J) Model	30.12.87

♦ = Conversion instructions or workshop campaign
∇ = Brochure
⊕ = Supplement or change for TI/QI

SERVICE

Date 30.04.90 VKQPI

Survey of Information Published in Technical Manual beginning in 1985

6 Cyl. 4

	TI/QI		No.	911 C2/C4	911		911 Turbo	Remarks, Model, Also refer to...	Date
1988									
– Brakes Brake Pads Without Asbestos	Q		1/88		●			Sweden, Norway, Denmark	29.04.88
– Emergency Collapsible Wheel Vredestein	Q		2/88		●		●	Repairing Not Permitted	22.07.88
– Propeller Shaft Crease / Optitemp	Q		3/88		●		●	New grease: Optitemp PU 35	05.09.88
– Recommended Winter Tires and Tire Chains	T		1/88		●		●		20.10.88
– Brake Pads Without Asbestos and Information for Adjusting Parking Brake	T		2/88		●		●	Survey - brake pads without asbestos	28.10.88
– New Tire Road Speed Designations and Summer Tire/Wheel Rim Survey	T		3/88		●		●		24.11.88
1989									
– Tire and Wheel Rim Survey	T		1/89	●				ZR tires for Carrera 4	08.02.89
– Front Axle - Wheel Carriers - Wheel Bearings	T		2/89	●				Cracking noises.	08.06.89
– Radial Oil Seals on Front Wheel Hubs	T		3/89	●			●	New sealring with studs	02.03.89
– Steering Gear Installation on Front Axle Cross Member	T	♦	4/89	●				Grating noises. WK 03 66000	08.06.89
– Replacing Spring Strut Mounting Parts on Front Axle	T	♦	5/89	●				Optimoly HT / 135 Nm WK 06 66000	08.06.89
– Correcting Special Tool P 300	T		6/89	●					15.06.89
– "VR" Summer Tires	T		7/89	●	●		●	Combined design of VR and ZR tyres.	16.07.89
– Survey of Summer Tires and Rims	T		8/89	●				Replaced	31.08.89
– Survey of Winter Tires, Rims and Tire Chains	T		9/89	●			●		29.09.89
– Survey of Winter Tires, Rims and Tire Chains	T		9/89	●			●		24.11.89
– Bolted Wheel Bearings on Front Axle	T		10/89	●				Cracking noises.	14.11.89
1990									
– Overview of tires and wheels/Type 959	T		1/90				●	Model 959 from M'89 (K)	26.02.90
– Breake system, rear axle Braking noise	T	♦	2/90	●				C 2: damping sheet, dampers.	23.03.90
– Survey of Summer Tires and Rims	T		3/90	●				Replced Nr. 8/89 of 31.08.1989	19.04.90

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Date 30.04.90 VKQPI

Survey of Information Published in Technical Manual beginning in 1985

6 Cyl. 4

	TI/QI		No.	911 C2-C4	911		911 turbo	Remarks, Model, Also refer to...	Date
– Front and rear brakes Damper shims and vibration dampers -survey	T		4/90	●				From M'89 (K)	24.07.90
– Survey of Summer Tires and Wheels	T		5/90	●				Replaces T № 3/90	16.08.90
– Summary of winter tires, wheels and snow chains	T		6/90	●	●		●	Replaces T № 9/89	28.08.90

◆ = Conversion instructions or workshop campaign
▽ = Brochure
⊕ = Supplement or change for TI/QI

SERVICE

Date
30.04.90 | 31.12.90
VKQPI

The workshop manual of the Carrera 4 also includes that for the Carrera 2.
The Carrera 4 acts as the basis for description of the repairs in the manual.
“Carrera 4" also appears on every page in the header line.

Deviating descriptions for repairs on the Carrera 2 follow those of the Carrera 4. These repair descriptions for both models are separated by a yellow sheet.
“Carrera 2" appears on all pages in the header line after the separating sheet. The page number starts with 100 as an additional distinction.

Printed in Germany - XXII, 1995

Brakes, mechanical

Brake - hydraulics, regulator, booster

Steering

Printed in Germany - XXII, 1995

Tightening torques for front-axle

Location	Thread	Tightening torque Nm (ft.lb.)
Cross member		
Cross member to chassis outer inner	 M 12 M 10	 100 (73) 46 (34)
Rubber-metal bearing to cross member	M 8	23 (17)
Central pipe / FA final drive		
Rubber-metal bearing to FA final drive	M 12	85 (62.5)
Rubber sealing disk (in area of clamping sleeve) to central shaft	M 6	10 (7.5)
Central tube to transmission (FA and RA drive)	M 12	85 (62.5)
Clamping sleeve to central shaft (FA and RA drive)	M 10	75 (55)
Drive shaft		
to FA drive	M 8	42 (31)
to wheel hub	M 22	460 (340)
Side member		
to chassis (front)	M 12	85 (62.5)
to cross member (rear)	M 10	46 (34)
Control arm/joint carrier		
Control arm front to side member	M 12	110* (81)*
Control arm rear to side member	M 12	85 (62.5)

* The screw with washer must be replaced each time the screw connection is undone.

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Location	Thread	Tightening torque Nm (ft.lb.)
Joint carrier to control arm (Castor excenter and fastening)	M 10	65 (48)
Joint carrier to wheel carrier (Ball joint)	M 12	65 (48)
Cooling-air guide for brakes to control arm	M 6	10 (7.5)
Spring strut/wheel carrier		
Spring strut to wheel carrier (camber adjustment)	M 12 x 1.25*	135 (101)*
Spring strut to chassis	M 8	23 (17)
Spring strut support mount to piston rod	M 14	80 (59)
Plug** of spring strut suppport mount (911 Carrera RS)	M 50	180** (133)
Brake caliper to wheel carrier	M 12	85 (62.5)
Speed sensor to wheel carrier	M 6	10 (7.5)
Retainer plate for wheel bearing on wheel carrier	M 8	37 (27)
Wheel hub on wheel carrier (Carrera 2 / turbo as of 91)	M 22	460 (339)
Stabilizer		
to side member	M 8	23 (17)
to stabilizer mount	M 10	46 (34)
Stabilizer mount to wheel carrier (balljoint)	M 10	35 (26)

* Only use original screws and hexagon nuts according to SP catalog (pitch, quality). Replace M 12 x 1.5 screws (gold-colored, tightening torque 120 Nm (88.5 ft.lb.)) if necessary. Lubricate threads (approx. 10 mm of beginning of threads) and head (bearing surface) of bolts with Optimoly HT.

** Do not undo plug while the vehicle is on its wheels. Replace plug after removal (micro-sealed plug).

Printed in Germany – XVI, 1992

Location	Thread	Tightening torque Nm (ft.lb).
Steering		
(unspecified values in repair group 48)		
Tie rod (ball joint) to steering arm	M 12	65 (48)
Universal joint to steering gear and steering shaft	M 8	23* (17)
Steering gear to cross member		Tightening torques and note in steering repair group
Wheel mount		
Wheel to hub	M 14	130 (96)

* Replace setscrews and locknuts each time they are removed.

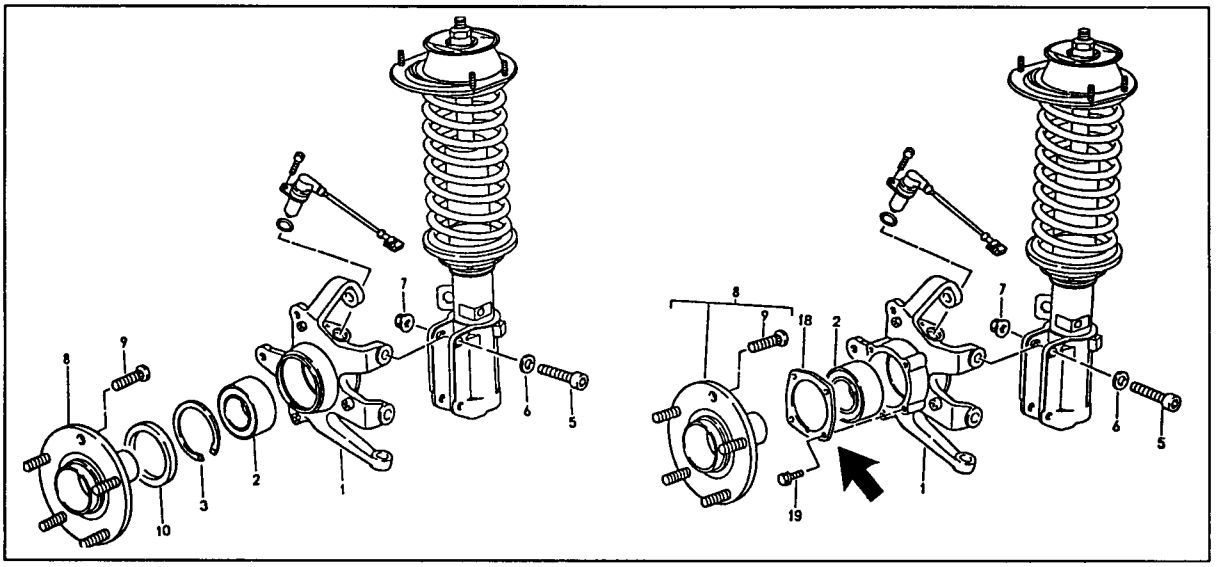
Printed in Germany – III, 1989

Installation instructions for wheel carrier

General

Modified wheel carriers have been used in the current model year 1990. The mounting of the wheel bearing in the wheel carrier has been changed.

Previous design: with internal circlip
Modified design: with screwed-on holding plate (arrow)



Previous design **Modified design**

Installation instructions

The modified wheel carrier (left and right) with screwed-on wheel bearing also applies retrospectively to all 911 Carrera 2 and Carrera 4 (Model '89/'90).
A mixed configuration for left and right is permitted.
Refer to TI group 4 for the exact part set.

The **sealing ring (10)** previously mounted on the wheel hub has now been omitted and must be **removed** during conversion to the modified wheel carrier design.

The wheel bearing is damaged when the wheel hub is pulled off and must be replaced.

The fixing screws (19) for the holding plate (18) must be greased with **Optimoly HT** at the start of the thread before screwing in. Tighten the screws with a torque of 37 Nm.

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Installation instructions for securing the wheel carrier at the spring strut:

Fillister-head screws (5), nuts (7) and washers (6) must be **renewed** after dismantling.
The washer and nut contact surfaces on the spring strut must be free of grease for assembly.
Grease screws (5) with **Optimoly HT** at the start of the thread (approx. 10 mm) and on the screw head (contact surface) before installation. **Tightening torque: 135 Nm.**

After renewal of one or both wheel carriers, the wheel alignment values (camber/toe) must be checked and readjusted if necessary.

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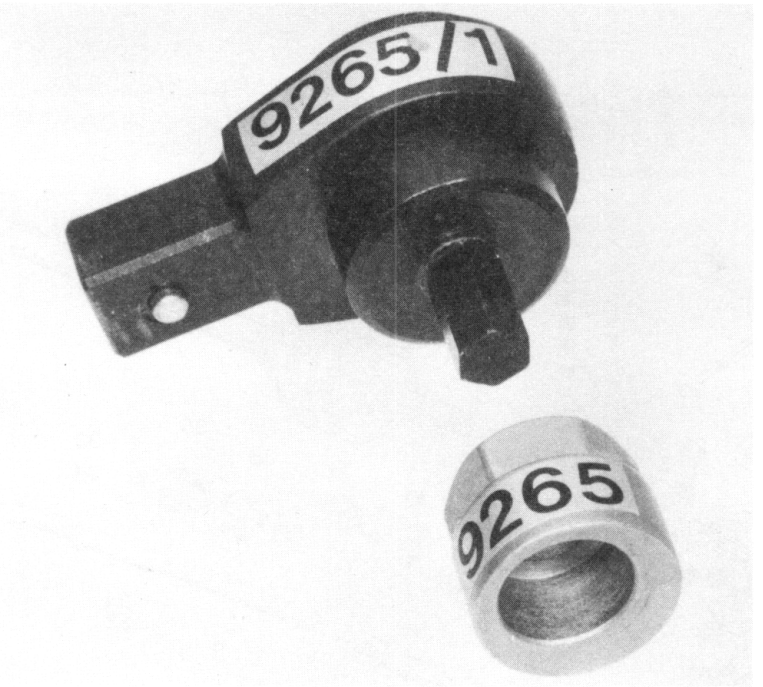
Dismantling and assembling wheel suspension

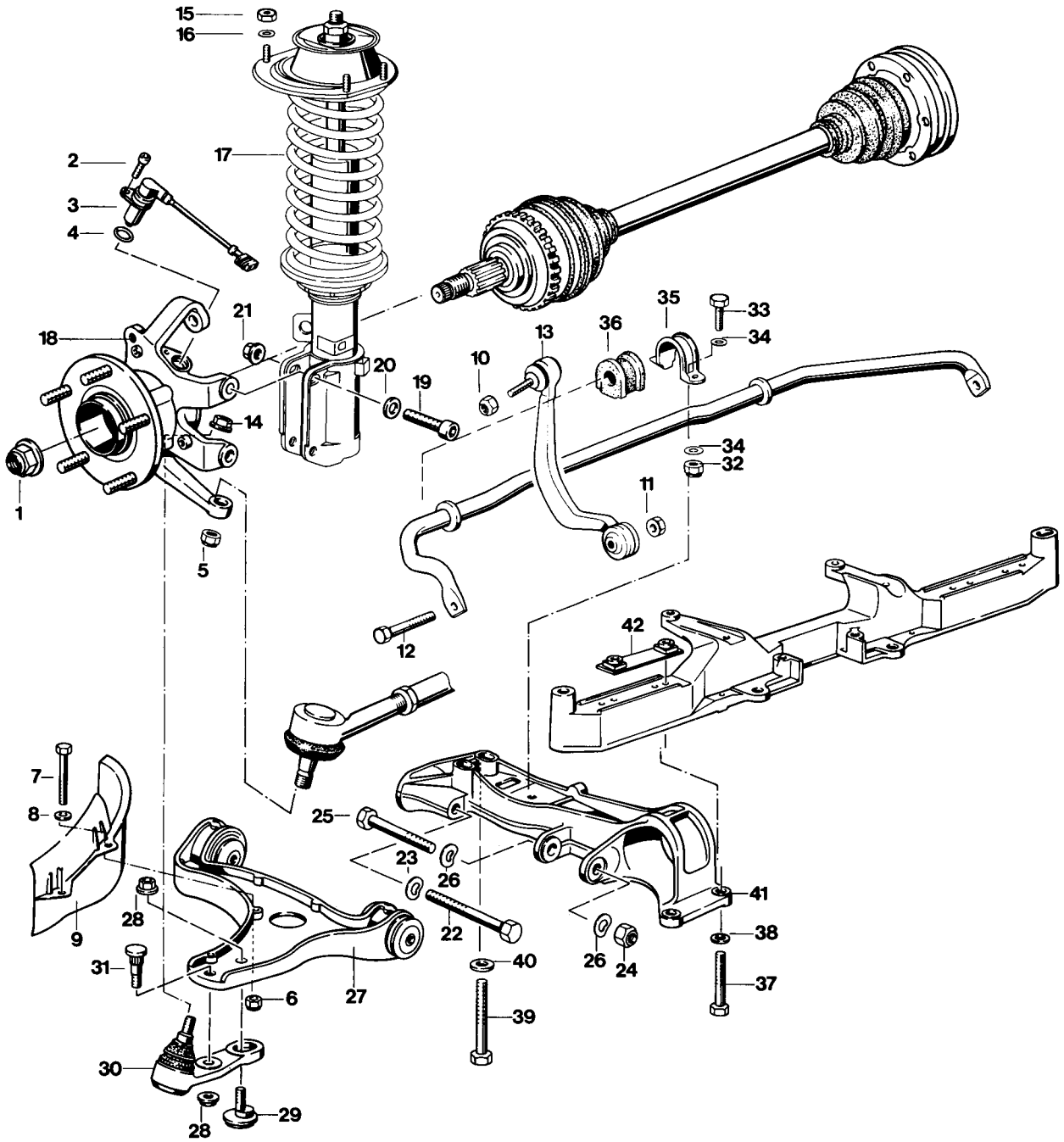
Tools



88/486

No.	Description	Special Tool	Order Number	Remarks
–	Excentric socket	9265	000.721.926.50	
–	Switchover socket-type ratchet	9265/1	000.721.926.51	
–	Tie rod extractor			commercially available e.g. Nexus 168-1
–	Ball joint extractor			commercially available fork aperture approx. 20 mm) e.g. Nexus 169-1. Used to press the ball joint off the wheel carrier

Dismantling and assembling wheel suspension



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No.	Designation	Qty.	Note: Removal	Installation
1	Lock nut	1	Before lifting the vehicle, undo the nut, actuating the brakes at the same time.	Replace. Coat thread and nut seating face with Optimoly HT. Tighten to 460 Nm (339 ftlb).
2	Pan head screw	1		Coat thread with Optimoly HT. Tighten to 10 Nm (7 ftlb).
3	Rpm sensor	1		Coat stem with Molykote Longterm.
4	Round seal	1		Replace
5	Lock nut	1		Replace. Ball joint and steering arm tapers free of grease. After inserting into the steering arm, coat thread with Optimoly HT. Tighten to 65 Nm (48 ftlb).
6	Lock nut	2		Replace. Tighten to 10 Nm (7 ftlb).
7	Bolt	2		
8	Washer	4		
9	Air duct	1		
10	Lock nut	1		Replace. Coat thread with Optimoly HT. Tighten to 46 Nm (34 ftlb).
11	Lock nut	1		Replace. Tighten to 46 Nm (34 ftlb).
12	Bolt	1		Coat thread with Optimoly HT.
13	Stabilizer bar mount	1		In case of replacement, observe references according to spare parts catalog.

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No.	Designation	Qty.	Note: Removal	Installation
14	Lock nut	1	Pull off ball joint of joint carrier using a suitable puller, e.g. Nexus 169 - 1. Prior to pulling, coat puller and rubber boot of ball joint with tire assembly compound.	Replace. Ball joint and wheel carrier tapers free of grease. Coat thread of ball joint with Optimoly HT. Tighten to 65 Nm (48 ftlb).
15	Hexagon head nut	4		Coat thread of spring strut support mount with Optimoly HT. Tighten to 23 Nm (17 ftlb).
16	Washer	4		
17	Spring strut	1	When removing the strut, it is not necessary to remove the wheel carrier and the subsequent parts (items 19 to 21).	
18	Wheel carrier	1		Coat internal splines of drive shaft with Optimoly HT. If the wheel carrier has been separated from the strut, check and/or adjust wheel alignment.
19	Pan head screw	2		Replace. Use only genuine screw. Observe fitting and lubricating instructions (pp. 40 - 02 and 40 - 2).
20	Washer	2		Replace. Seating face on strut is grease-free.
21	Lock nut	2		Seating face on strut is grease-free.

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No.	Designation	Qty.	Note: Removal	Note: Installation
22	Hexagon head bolt M 12 x 1,5 10.9	1		Replace bolt and washer item 23 whenever the bolt has been undone. Coat thread with Optimoly HT. Tighten to 110 Nm (81 ftlb).
23	Washer	1		Replace
24	Lock nut M 12 x 1,5	1		Replace. Tighten to 85 Nm (63 ftlb).
25	Hexagon head bolt M 12 x 1,5	1		Coat thread and stem with Optimoly HT.
26	Spring washer Washer	1 1		Replace spring washer. Place spring washer under lock nut.
27	Control arm	1		If the joint carrier (item 30) has been separated from the control arm, check and/or adjust the wheel alignment. No welding or straightening is permitted on those parts
28	Lock nut	2	Undo only when control arm or joint carrier is to be replaced	Replace after removal. Tighten to 65 Nm (48 ftlb).
29	Caster excenter adjuster	1		Coat eccentric running surf. with Optimoly TA
30	Joint carrier (ball joint)	1		Ball joint and wheel carrier tapers free of grease
31	Knurled screw	1		Coat thread with Optimoly HT.
32	Lock nut	1		Replace. Tighten to 23 Nm (17 ftlb).

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No.	Designation	Qty.	Note: Removal	Note: Installation
33	Hexagon head bolt	1		Coat thread with Optimoly HT.
34	Washer	2		
35	Bracket	1		
36	Stabilizer bar mount	1		In case of replacement, observe references according to spare parts catalog. When fitting, coat with tire assembly compound or Omnis 32 (Texaco).
37	Hexagon head bolt M 10	2		Coat thread with Optimoly HT. Tighten to 46 Nm (34 ftlb).
38	Washer	2		
39	Hexagon head bolt M 12 x 1,5	2		Coat thread with Optimoly HT. Tighten to 85 Nm (63 ftlb).
40	Washer	2		
41	Side member	1		
42	Threaded plate	1		

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Dismantling and assembly notes

Dismantling

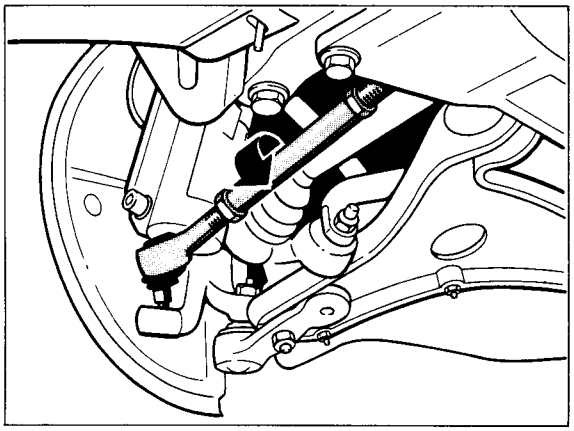
1. Before lifting the vehicle, unbolt drive shaft mounting on wheel end, actuating the brake to keep the shaft from rotating.

2. Take off front wheel.

3. Open multi-plug socket at spring strut and take out connector.
   Unclip electrical wire from strut.

4. Separate brake line of spring strut from brake hose and remove brake caliper.
   Before performing this operation, press down pedal with pedal retainer unit to avoid brake fluid from flowing in from the reservoir.

5. Press tie rod ball joint out of steering arm using a suitable puller, e.g. Nexus 168-1.
   Start by undoing the inner lock nut at the tie rod adjuster, however. Turn tie rod and ball joint to the rear (arrow). Extend ball joint.



859-40

6. Remove brake cooling air duct from control arm.

7. Separate stabilizer bar mount at stabilizer bar and wheel carrier.

8. Undo wheel carrier (ball joint) and pull off with suitable puller e.g. Nexus 169-1.

Note

To avoid damaging the rubber boot of the ball joint, coat rubber boot and puller in this area with some tire assembly lubricant.
Insert puller from the front end.

9. Remove spring strut and wheel carrier.
   Undo spring strut/wheel carrier bolt joint (for camber adjustment) only when replacing those components.

Note

When removing the control arm, unbolt joint carrier/control arm union (caster adjuster) only when replacing control arm and/or joint carrier.

10. When removing the control arm, unbolt joint carrier/control arm union (caster adjuster) only when replacing control arm and/or joint carrier.

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Assembly

1. Assemblle in reverse order. Check parts visually prior to assembly. Compare with new parts if required.
   No welding and straightening operations are permitted on suspension components.
   Use prescribed assembly compounds.
   Observe correct tightening torques.

2. Replace front control arm fastening screw (M 12/10 g), along with its washer whenever it has been undone or removed.
   When fitting the control arm, start by screwing in the control arm mounting bolts only lightly.
   Caution: Do not tighten the bolts until the vehicle rests on its wheels.

3. To avoid confusion when replacing parts (**993 and 964 parts** and, in certain cases, right-hand and left-hand parts), observe **parts usage** according to spares catalog. **In addition**, check parts prior to assembly referring to the identification mark / casting number of the **inscribed** part number (identification feature).

   964 parts (911 Carrera 2/4) = casting number starting with 964. 993 parts (911 Carrera as of MY '94) = casting number starting with 993.

   Spare part for left-hand side:
   3rd group of part number = **odd** number.
   Spare part for right-hand side:
   3rd group of part number = **even** number.
   Example:
   Right-hand part
   (control arm) = 964.341.018.06
   Left-hand part
   (control arm) = 964.341.017.06

Note

— The following front-axle parts or adjacent parts differ from each other only in minor details:

— Side member

— Control arm with **mounting bolts/mounting nut**

— Joint carrier

— **993** = olive-colored. Bore diameter of wheel carrier mount = 12 mm

— **964 = gold-colored**. Bore diameter (mount) = 10 mm

— Stabilizer bar / stabilizer bar mount

— Vibration damper

— Tensioning disc (ABS gear)
964 = 45 teeth
993 = 48 teeth

— Steering gear

— Brake booster with bracket

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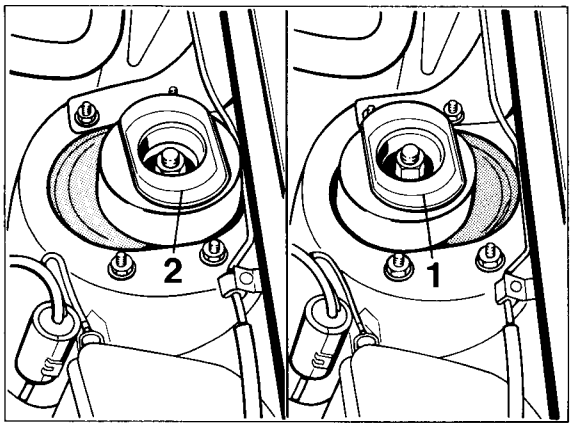
4. Fit spring strut support mount to spring strut tower in correct position.

   1 = Carrera 4 / Carrera 2
   2 = Turbo / Turbo-Look



860-40

5. Bleed front brake circuit (conventional method).

6. When assembling or replacing components that affect the vehicle height, check wheel alignment and vehicle ride height.
   When replacing parts or undoing nut/bolt unions that affect wheel alignment only, it is sufficient to check and/or adust wheel alignment only, ist is sufficient to check and/o adjust wheel alignment.

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Removing and installing halfshaft

Removing

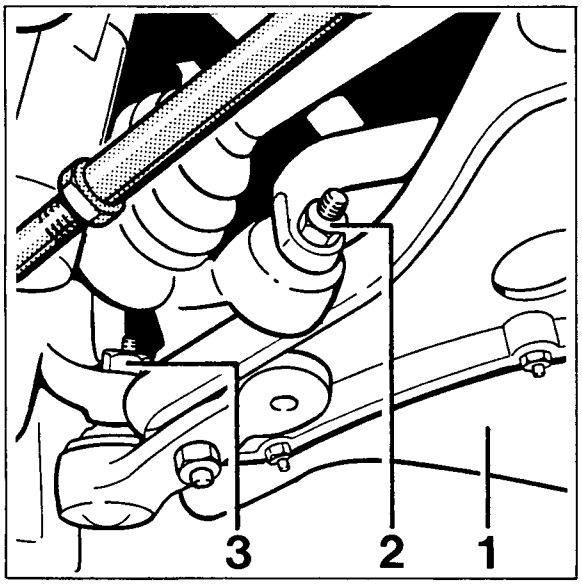
1. Before raising the vehicle, undo halfshaft mounts on the wheel side. Apply the brakes at the same time.

2. Remove front wheel and underside panel.

3. Remove brake cooling duct from A-arm (1). Undo stabilizer mount at stabilizer bar (2). Undo joint carrier (ball joint at wheel carrier and press off using a suitable puller, e.g. Nexus 169-1 (3).

Note

To avoid damaging the rubber bellows of the ball joint, coat the rubber bellows and the corresponding area of the puller with tire assembly compound. Then fit the puller from the front.

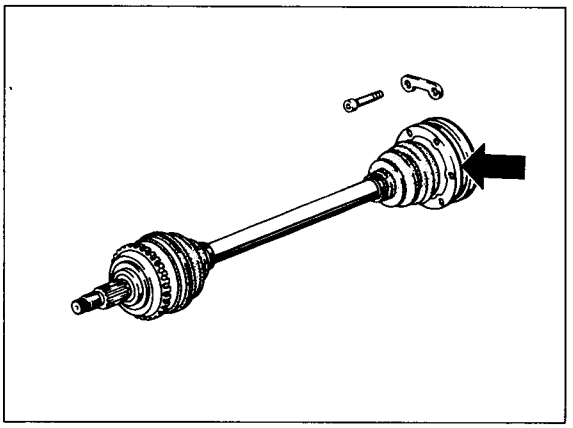


1093-40

4. Remove pan head screws of halfshaft from transmission flange.

Note

The CV joint may separate by itself if the bellows retainer (arrow) has been removed or is damaged.
The joint must therefore be protected against seperating by fitting two 8 mm bolts with nuts when it is removed and installed or transported.



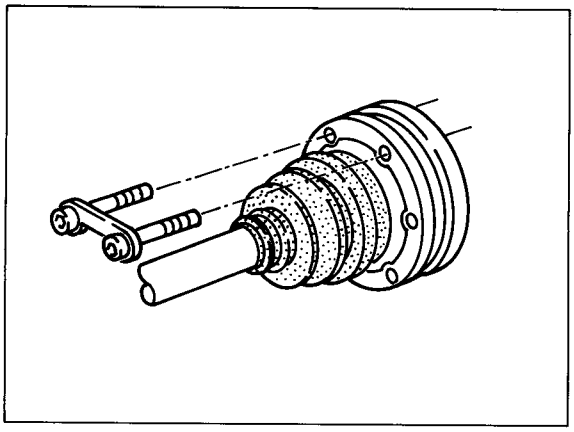
1094-40

5. Extend halfshaft.

Installation

1. Coat splines, threads and stem of the halfshaft with Optimoly HT.

2. Place support plates on pan head screws and apply a thin coat of Optimoly HT to the threads.
   Put pan head screws with support plates into halfshaft flange, making sure the flange cover is not greased (accidentally).



775-42

3. Put halfshaft into position and fit pan head screws.
   Coat mounting surface of new M 22 x 1.5 lock nut with Optimoly HT and fit lock nut.

4. Fit joint carrier (ball joint) to wheel carrier.
   Taper of ball joint and wheel carrier must be free from grease.
   Apply a coat of Optimoly HT to ball joint threads. Replace lock nut.

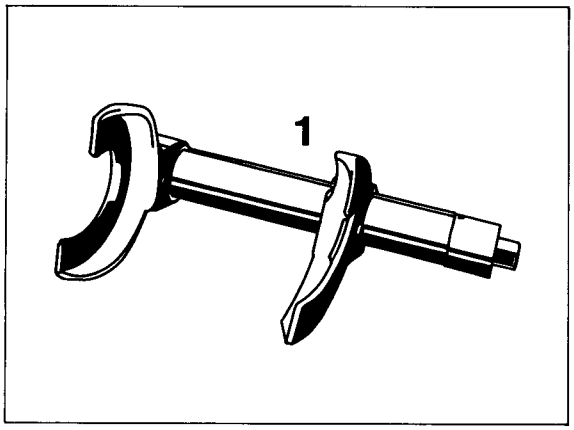
5. Fit brake cooling air duct and stabilizer mount. Replace lock nuts.

6. **Tighten all nuts and bolts to the specified torque.**
   Fit wheel and underside panel.

Dismantling and assembling spring strut

Dismantling

– Using a spring tensioner (e.g. tool supplied by Klann), preload coil spring until the piston rod is slack.



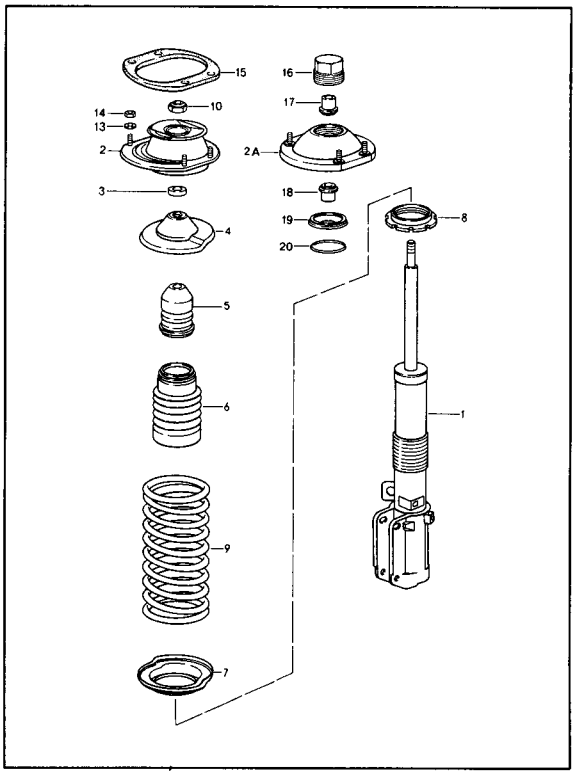
770-42

– To unbolt the bolt joint (piston rod to strut mount), use a 7 mm Allen key to keep the piston rod from turning.
Caution: Never use an impact screwdriver to undo and tighten the lock nut.

– Take all parts off the piston rod.

Note

Parts Nos. **16 to 20 and No. 2A** of the below drawing are only applicable to the Carrera RS.



2046-40

Assembly

– Replace lock nut that secures the piston rod at the spring strut mount.
Coat threads and stem with Optimoly **HT**.

– If required (e.g. when replacing the vibration damper), set adjusting nut No. 8 into the **same position** as on the old vibration damper (transfer setting to the new damper).
Coat threads of the adjusting nut with Optimoly **TA**.

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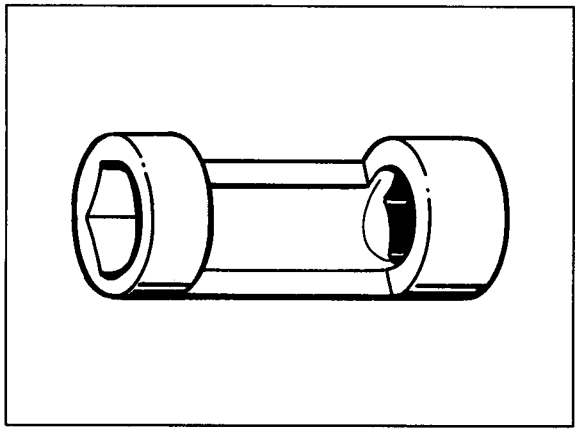
- When fitting progressive-acting coil springs, make sure the **close coils** face the strut mount.

- It is recommended to replace the coil springs only in pairs.
  Observe references according to spare parts catalog.

- When tightening the lock nut of the strut mount, use a semi-open socket, e.g. of the type supplied by Hazet.
  In this way, the nut can be tightened exactly to the specified tightening torque of **80 Nm** (59 ftlb.). At the same time an angled 7 mm Allen key may be used to prevent the piston rod from turning.
  Caution: Never use an impact screwdriver to tighten the lock nut.



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Tightening torque for rear axle

Location	Thread	Tightening torque Nm (ft.lb.)
Rear axle link / spring brace		
RA link to chassis	M 14	200 (147)
Spring brace to chassis	M 14	200 (147)
Spring brace to RA link fastening	M 14	200 (147)
Camber eccentric	M 14	200 (147)
Toe eccentric	M 12	58 (43)
Retaining plate for wheel bearing	M 8	20 (15)
Holder and ground cable to RA link	M 6	10 (7,5)
Speed sensor to RA links	M 6	10 (7,5)
Brake cover plate to RA link	M 6	10 (7,5)
Brake caliper to RA link	M 12	85 (63)
Drive shaft		
to RA drive	M 8, M 10	42 (31), 80 (59)
to wheel hub	M 22	460 (340)
Lock nut	M 22	200* (147)
Stabilizer		
to chassis	M 8	23 (17)
to stabilizer mount	M 12	85 (63)
Stabilizer mount to RA	M 10	46 (34)

*Added for 911 Carrera RS. Chamfer of lock nut faces fastening nut.

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Location	Thread	Tightening torque Nm (ft.lb.)
Spring strut		
Spring strut to body*	M 8 M 8	20 (15) on original version 37 (27) for recessed version**
Spring strut to rear axle trailing arm	M 14	200 (148)
Spring strut support bearing to spring strut (piston rod)	M 12	58 (43)
Plug*** of spring strut support mount (911 Carrera RS)	M 50	180***(133)
Wheel mounting		
Wheel to wheel hub	M 14	130 (96)

* Distinction between the two versions on Page 42 - 1

** 37 Nm (27 ftlb) with shouldered nut (Part number 900.380.006.02) and 3.1 mm thick washer (Part number 999.025.125.02) see Page 42 - 1. Make quite sure that no other washers/nuts are installed.

***Do not undo plug while the vehicle is on its wheels. Replace plug after removal (micro-sealed plug).

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Notes on recessed spring strut mount from 1991 model on

General information

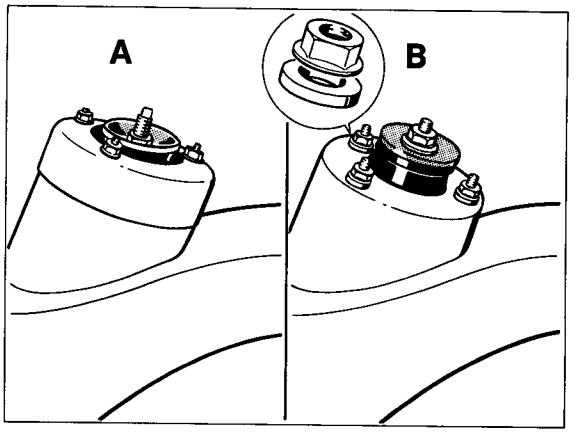
From the 1991 model on, all 911 Carrera cars have the rear-axle spring strut mounts recessed by 22 mm. As a result, the following spring strut parts have also had to be modified:

- Spring strut support bearing = modified pattern **and change in tightening torque** for bolted connection between spring strut support bearing / body
- Shock absorber (outer tube length)
- Rear axle spring
- Protective gaiter and bump stop

Distinguishing feature / change in tightening torque

– **Original version = A**
Tightening torque 20 Nm (15 ftlb)

– **Modified / recessed version = B**
Tightening torque 37 Nm (27 ftlb)
Installed with 3.1 mm thick washer (999.025.125.02) and shouldered nut (900.380.006.02)



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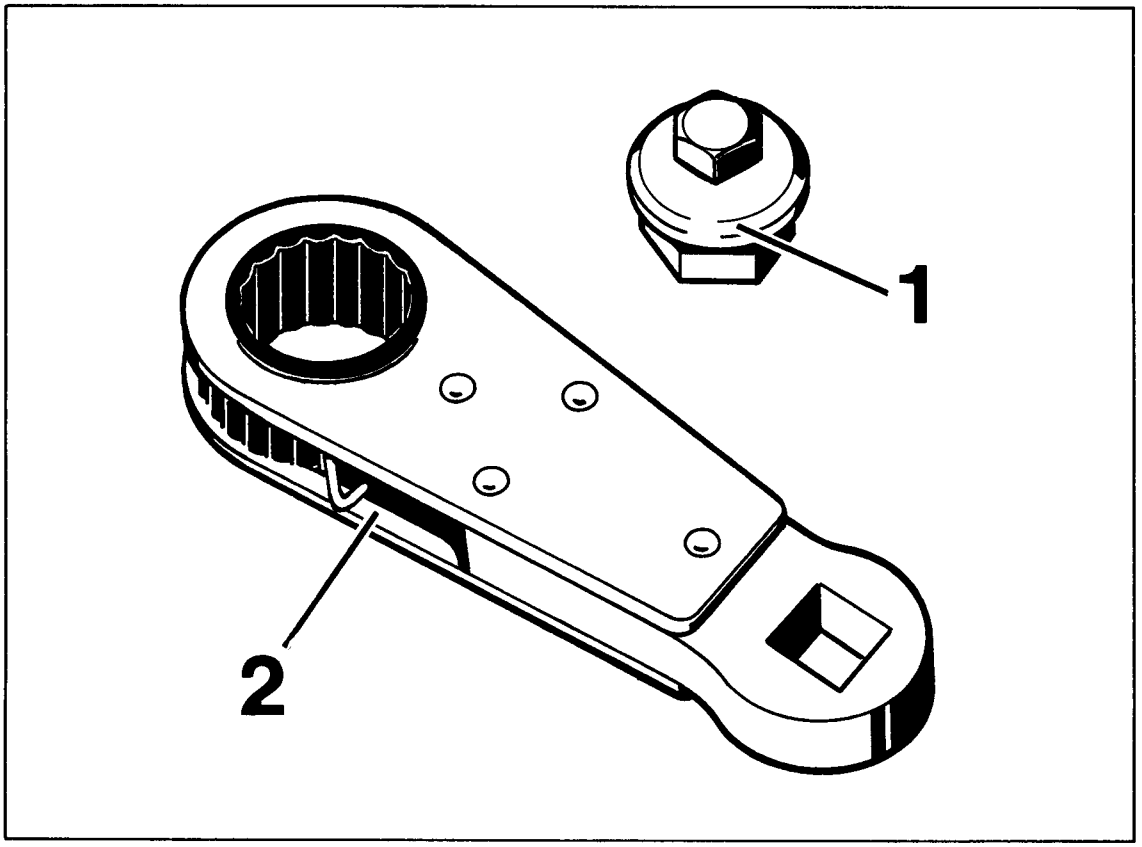
Dismantling and assembling wheel suspension

Tools



346-42

No.	Designation	Special tool	Order number	Explanation
1	Screw-in adapter	9299	000.721.929.90	
2	Ratchet torque adapter	9299/1	000.721.929.91	
–	Self-release torque wrench 1/2"			Commercial item. Required for dismantling/assembly of trailing arm along with Special Tool – No. 1 and No. 2

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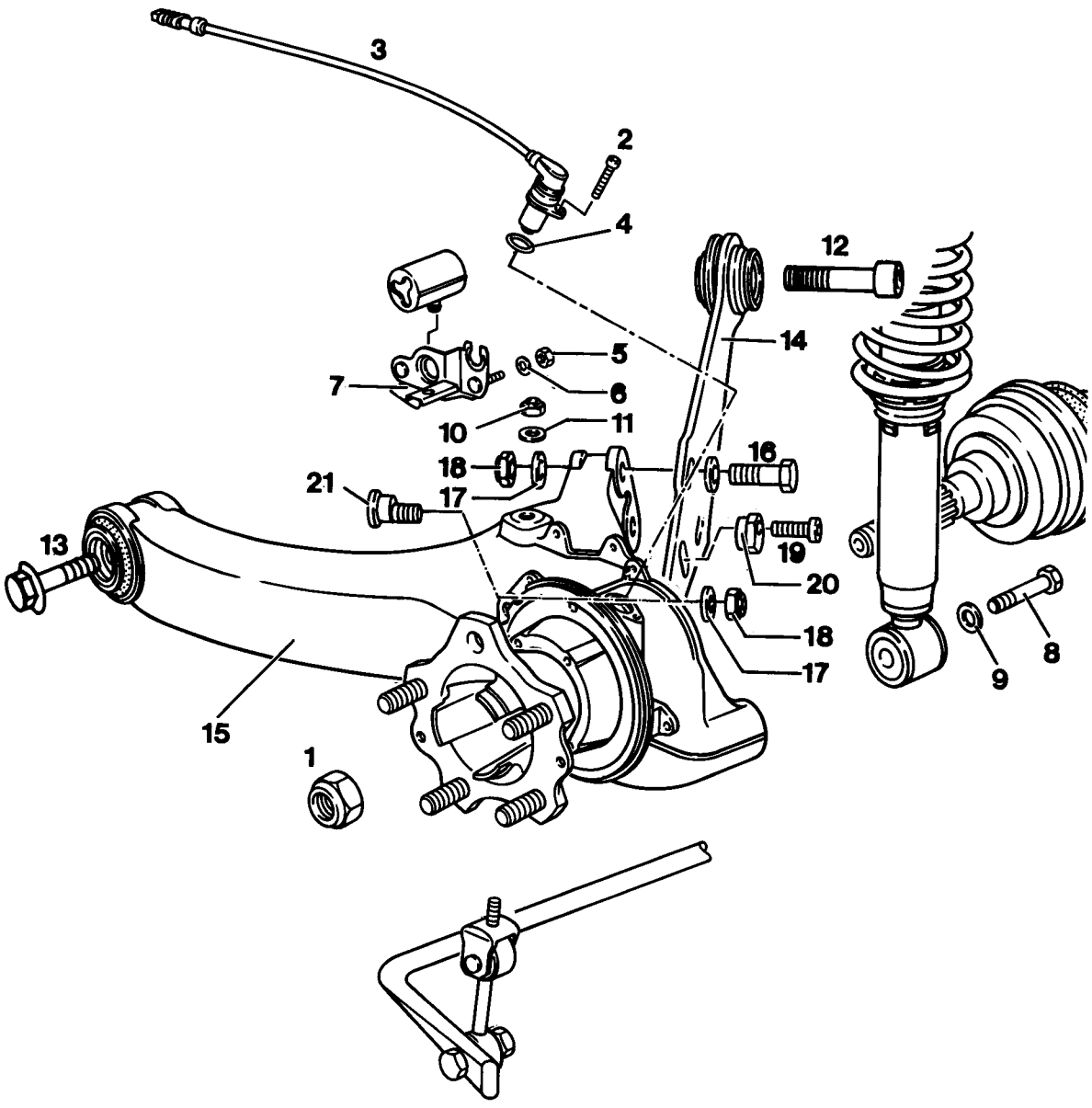
Dismantling and assembling wheel suspension



758- 42

No.	Designation	Qty.	Note: Removal	Installation
1	Lock nut M 22 x 1.5	1	Operate parking brake	Replace. Coat thread and nut mating surfaces with Optimoly HT. Tighten to 460 Nm (339 ftlb)
2	Pan head screw M 6 x 30	1		Coat thread with Optimoly TA. Tighten to 10 Nm (7 ftlb)
3	Rpm sensor	1		Coat stem with Molykote Longterm
4	Round seal	1		Replace
5	Lock nut M 6	2		Replace. Tighten to 10 Nm (7 ftlb)
6	Washer M 6	2		
7	Bracket with connector	1		
8	Hexagon head bolt M 14 x 1.5 x 100	1		Coat thread and stem with Optimoly HT. Tighten to 200 Nm (147 ftlb)
9	Washer M 14	1		
10	Lock nut M 10	1		Replace. Coat thread with Optimoly HT. Tighten to 46 Nm (34 ftlb)
11	Washer M 10	1		
12	Pan head screw M 14 x 1.5 x 100	1		Coat thread and stem with Optimoly HT. Tighten to 200 Nm (147 ftlb)
13	Hexagon head bolt M 14 x 1.5 x 120	1		Coat thread and stem with Optimoly HT. Tighten to 200 Nm (147 ftlb)

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No.	Designation	Qty.	Note: Removal	Installation
14	Rear-axle spring brace	1	To remove the rear-axle trailing arm, removal of the rear-axle spring brace and of the following parts (items no. 16 to no. 21) is not required	
15	Rear-axle trailing arm	1		If the trailing arm has been separated from the rear-axle spring brace (no. 14), perform wheel alignment. Welding and straightening operations are not permitted
16	Hexagon head bolt	2		
17	Washer	5		
18	Lock nut M 14 x 1.5	3		Coat thread with Optimoly HT. Tighten to 200 Nm (147 ftlb)
19	Pan head screw M 12 x 1.5 x 35	1		Coat thread with Optimoly TA. Tighten to 58 Nm (43 ftlb)
20	Wheel toe–eccentric adjuster	1		Coat eccentric running surface with Optimoly TA
21	Camber–eccentric adjuster M 12 x 1.5 x 35	1		Coat eccentric running surface with Optimoly TA

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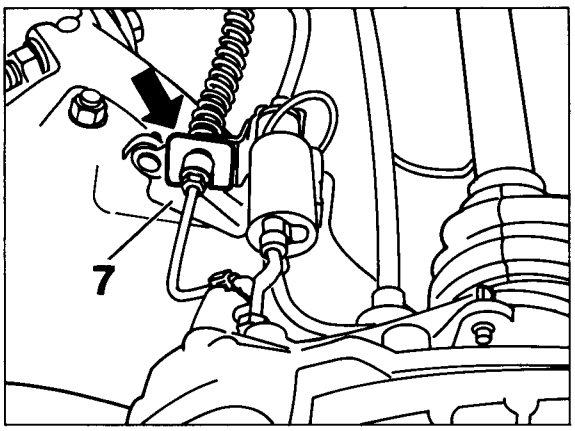
Dismantling and assembly notes

Dismantling

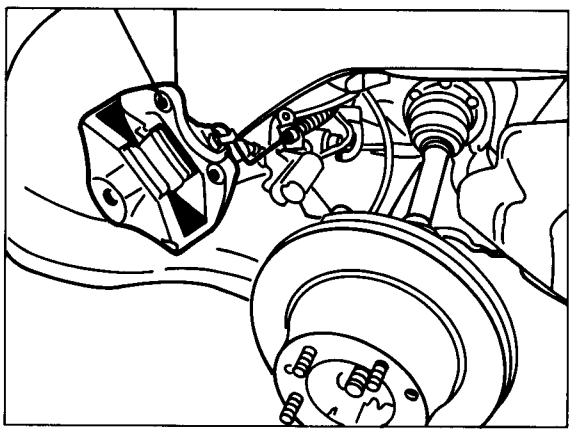
1. Remove rear wheel.

2. Take lock spring (arrow) off brake hose and remove bracket (7) from rear-axle trailing arm.



759-42

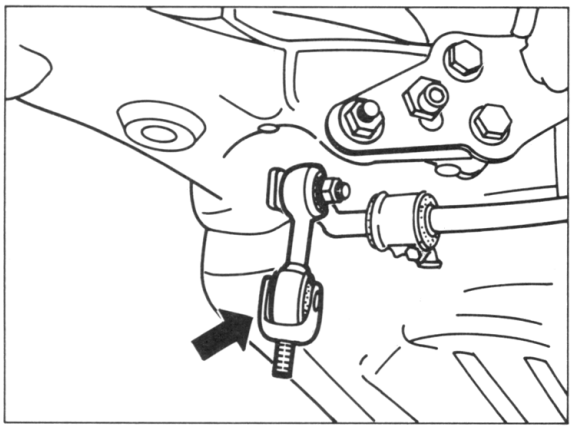
3. Unbolt brake caliper from rear-axle trailing arm and suspend at wheel housing.



760-42

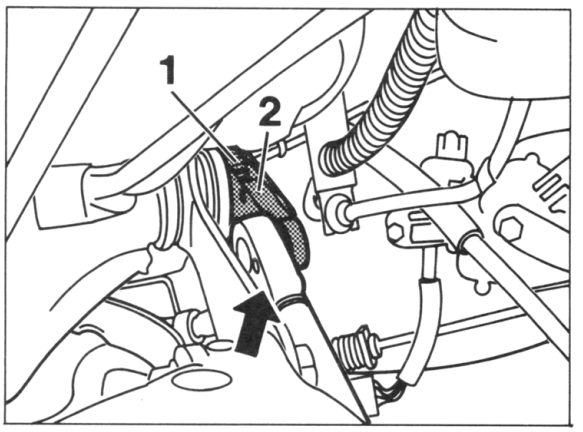
4. Remove parking brake assembly from rear-axle trailing arm.

5. Unbolt stabilizer bar mounts (arrow) from stabilizer bar. Raise rear-axle trailing arm somewhat, extend mount and let hang down.



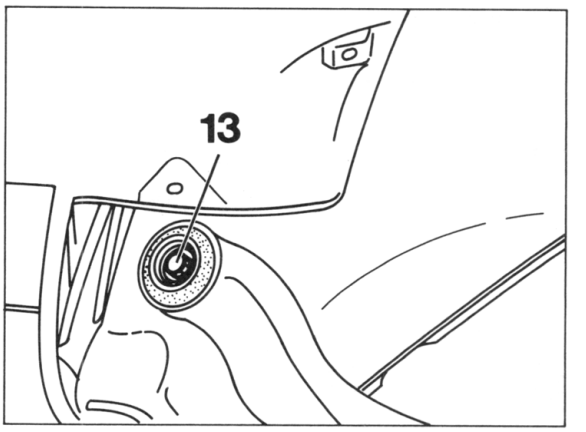
761-42

6. On the 911 Carrera with Tiptronic, disconnect connector at transmission.
Remove pan head screw with Special Tools 9299 and 9299/1 (no. 1/no. 2) in conjunction with a torque wrench (arrow).



762-42

7. Remove side member panel and screw out hex bolt (13).



763-42

8. Suspend drive shaft at spring strut or spring strut tower, respectively, in horizontal position.

Assembly

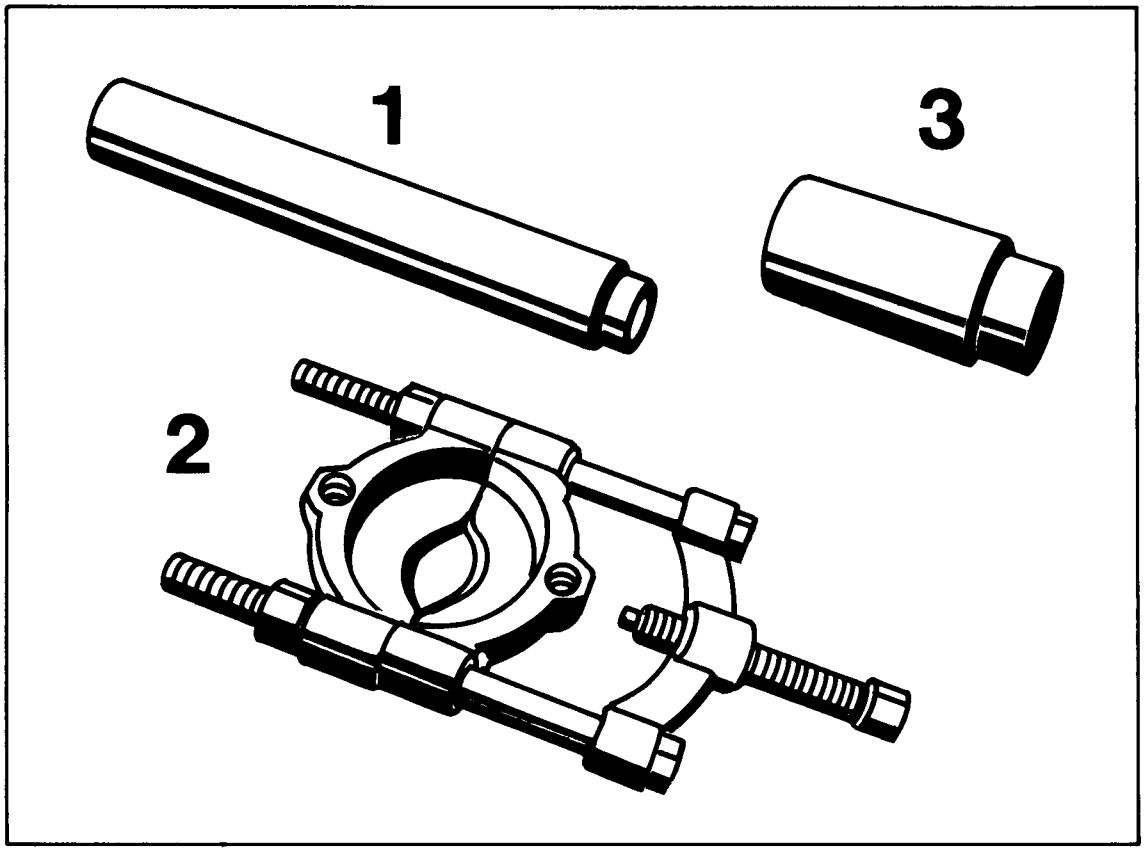
Assemble in reverse order.

Welding or straightening work on suspension parts is not permitted.

If the rear-axle spring brace has been undone or removed from the rear-axle trailing arm or if components have been dismantled that affect vehicle height, check wheel alignment of front and rear axle.

Replacing wheel bearings

Tools



764-42

No.	Designation	Special tool	Order number	Explanation
1	Pressure piece 40 mm dia., 31.3 mm dia.	P 297 A		Used to press rear wheel hub in and out
2	Separating device			Support for wheel bearing when pressing out the rear wheel hub
3	Pressure piece 50 mm dia., 39.3 mm dia.	VW 432		To press wheel bearing in and out

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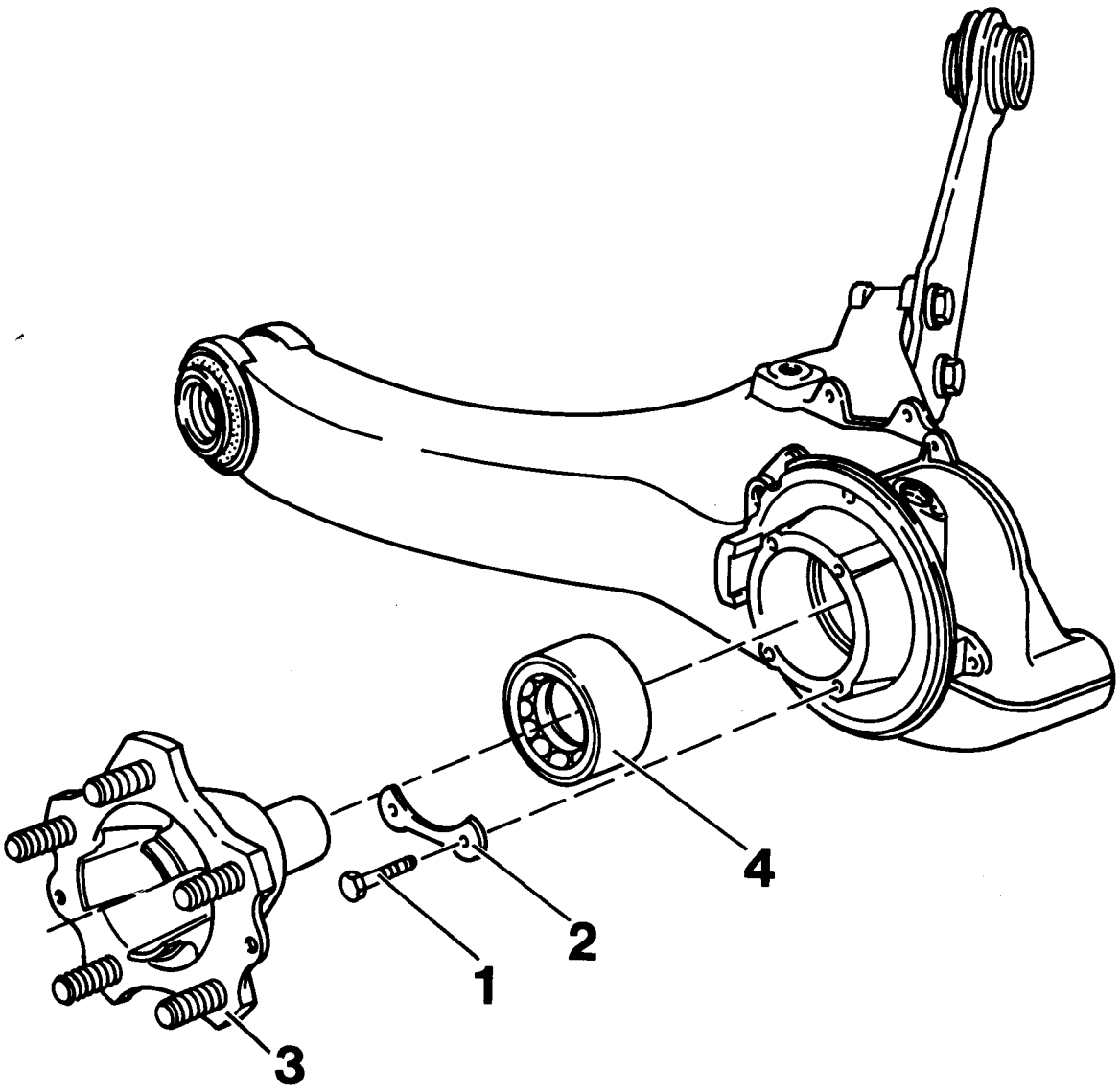
Replacing wheel bearings



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No.	Designation	Qty.	Note: Removal	Installation
1	Hexagon head bolt M 8 x 40	4		Coat thread with Optimoly TA. Tighten to 20 Nm (15 ftlb)
2	Retainer plate	2		
3	Rear wheel hub	1	Press out using a 31.3 mm dia. drift P 297 A and separating device on a hydraulic press	Press in place using 40 mm dia. drift P 297 A
4	Angular contact ball bearing	1	Heat rear-axle trailing arm to 120 – 150 deg.C. Press out angular-contact ball bearing with thrust piece VW 432 using suitable supports	Heat rear-axle trailing arm to 120 – 150 deg.C. Put new angular contact ball bearing in place and follow by pressing in lightly

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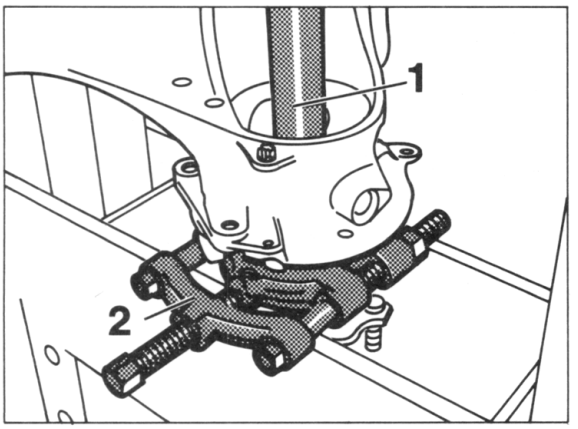
Removal and installation notes

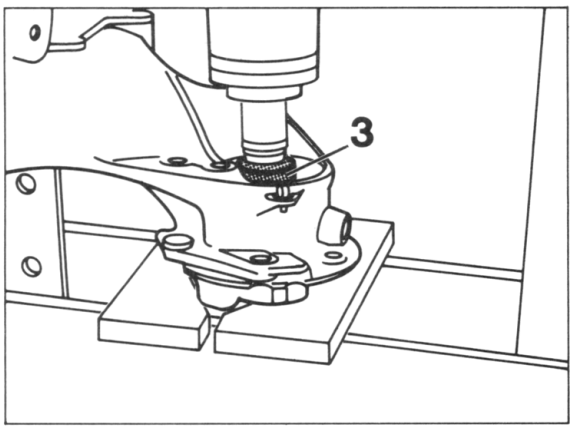
Removal

1. Press out rear wheel hub with pressure piece P 297 A (1), using separating device (2) as a support.



766-42

2. Heat rear-axle trailing arm to 120 – 150 °C. Press in angular contact ball bearing using pressure piece VW 432 (3) and suitable supports.



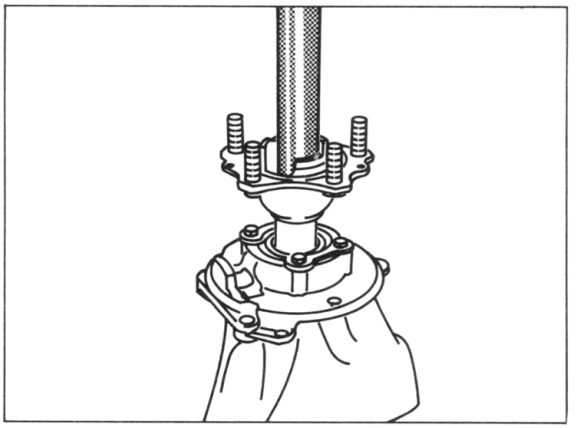
767-42

Installation

1. Prior to pressing in the wheel bearings, heat rear-axle trailing arm to 120 – 150 °C. Insert angular contact ball bearing and follow by pressing in lightly using suitable supports.

2. Insert retainer plates and tighten hexagon head bolts to 20 Nm (15 ftlb).

3. Press in rear wheel hub with pressure piece P 297 A (large diameter). Use a suitable support for the angular contact ball bearing.

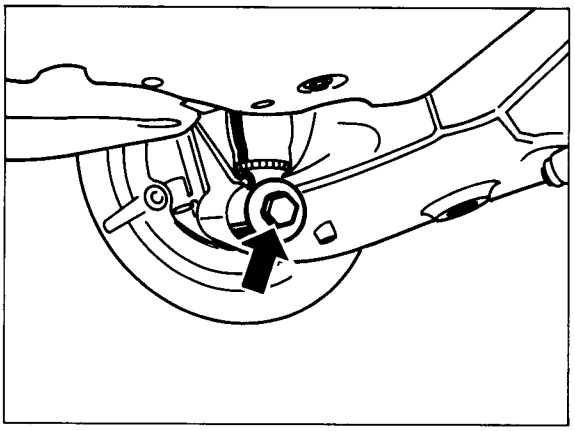


768-42

Removing and installing spring strut

Removal

1. Remove rear wheel. Undo hex bolt (arrow) from rear-axle trailing arm.



769-42

2. Remove heater blower and air cleaner, respectively.

3. Undo lock nuts M 8 (3 pc.) from spring strut support mount.

4. Extract spring spring strut from spring strut tower.

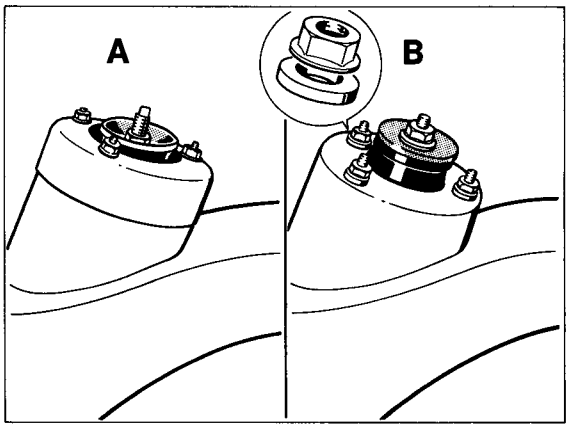
Installation

1. On cars as of MY '91, coat outside diameter of shock absorber mount with tire assembly compound. Insert spring strut into spring strut tower.

2. Use new lock nut when fitting spring strut support mount to body. Coat thread with Optimoly HT.

A = Initial version
Tightening torque 20 Nm (15 ftlb).

B = Revised / lowered version as of MY' 91
Tightening torque 37 Nm in conjunction with 3.1 mm washer (999.025.125.02) and collar nut (900.380.006.02).



635-42

3. Install heater blower and air cleaner, respectively.

4. Fit shock absorber to rear-axle trailing arm, coating the hexagon head bolt (M 14 x 1.5 x 100) with Optimoly HT along thread and stem, and tighten to 200 Nm (147 ftlb).

5. When fitting new parts that affect vehicle height, check alignment of front and rear axle.

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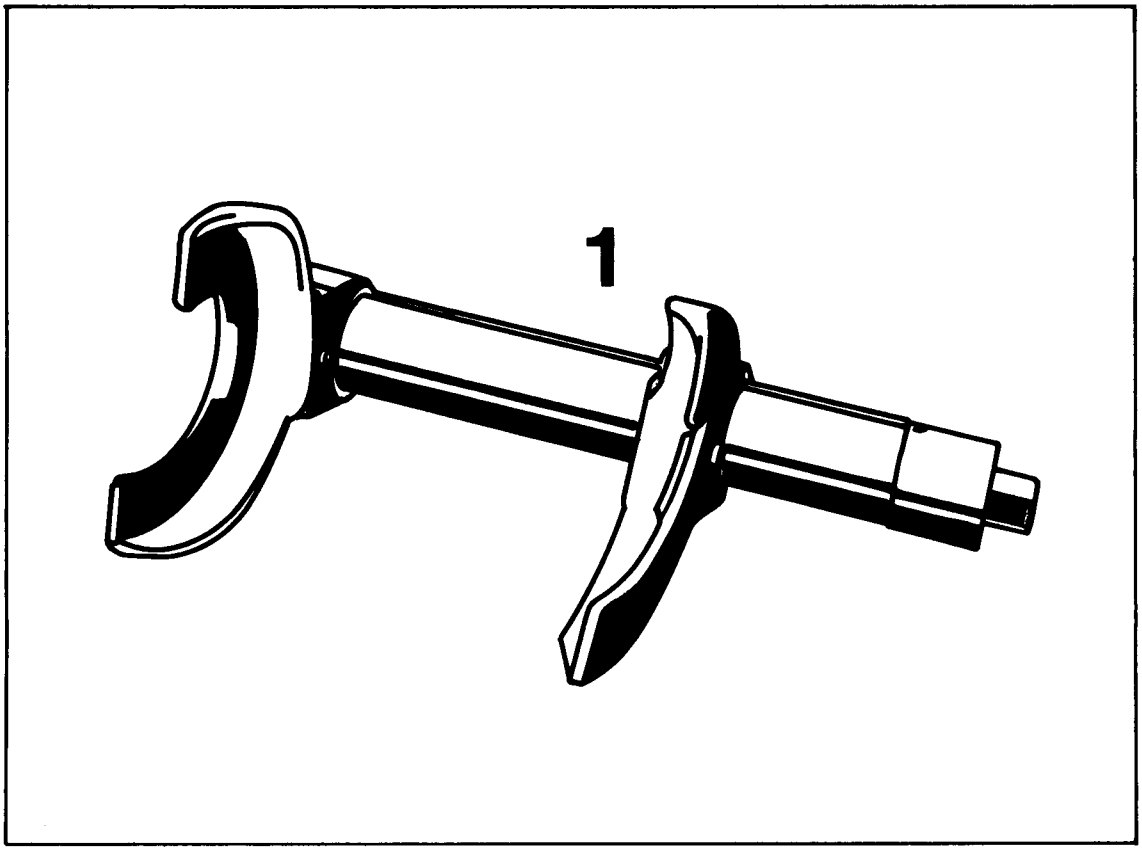
Dismantling and assembling spring strut

Tools



770-42

No.	Designation	Special tool	Order number	Explanation
1	Spring tensioner e.g. supplied by Klann			Commercially available

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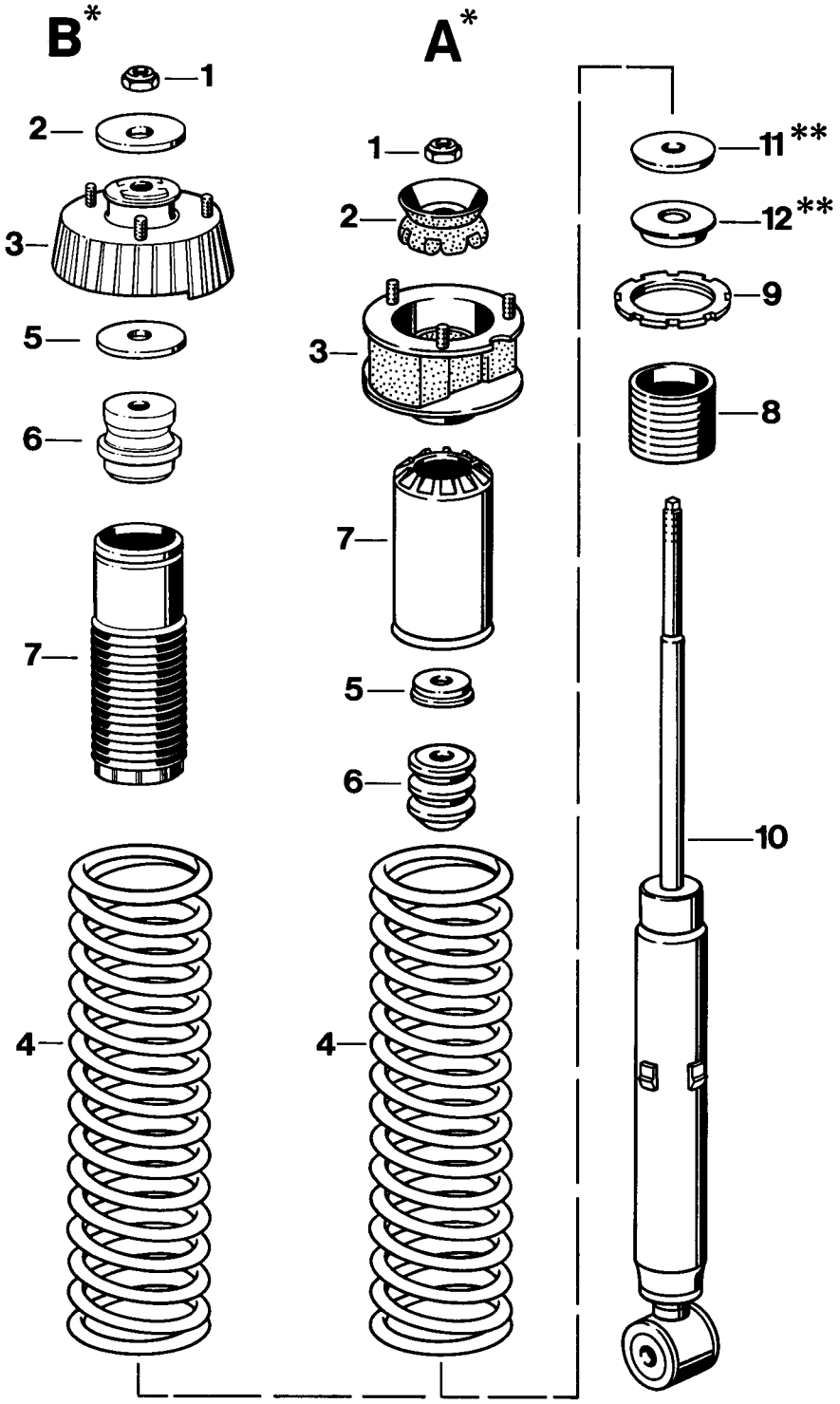
Dismantling and assembling spring strut



* A = Initial version B = Modified version as of Model '91

** Only present with version A

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Version A (initial version)

No.	Designation	Qty.	Note: Removal	Installation
1	Lock nut M 12 x 1.5	1	Before undoing the lock nut, preload coil spring with spring tensioner and take load off piston rod	Use new lock nut. Coat thread with Optimoly HT. Tighten to 58 Nm (43 ftlb)
2	Shock absorber mount	1		
3	Spring strut mount	1		
4	Coil spring	1		
5	Support ring	1		Install in correct position
6	Auxiliary spring	1		Observe references acc. to spare parts catalog
7	Protective tube	1		
8	Threaded bushing	1		Coat thread with Optimoly TA
9	Adjuster nut	1	Record adjusting distance (position)	Coat spring mounting face with Optimoly TA. Install in correct position (guide pointing towards spring)
10	Vibration damper	1		Observe references acc. to spare parts catalog
11	Thrust washer	1		Install with grooves facing down
12	Support cover	1		

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Version B (as of Model '91)

No.	Designation	Qty.	Note: Removal	Note: Installation
1	Lock nut M 12 x 1.5	1	Preload coil spring with spring tensioner before undoing the lock nut and unload piston rod	Use new lock nut. Coat threads with Optimoly HT. Tighten to 58 Nm (43 ftlb)
2	Washer	1		Install in correct position
3	Strut mount	1		Coat with tire assembly compound along outside diameter
4	Coil spring	1		Observe references acc. to spare parts catalog
5	Washer	1		Install in correct position
6	Auxiliary spring	1		Observe references acc. to spare parts catalog. Fit at protective bellows (No. 7)
7	Protective bellows	1		
8	Threaded sleeve	1		Coat threads with Optimoly TA
9	Adusting nut	1	Record adjustment setting (position)	Coat spring contact surface with Optimoly TA. Install in correct position (guide must point towards spring)
10	Vibration damper	1		Observe references acc. to spare parts catalog

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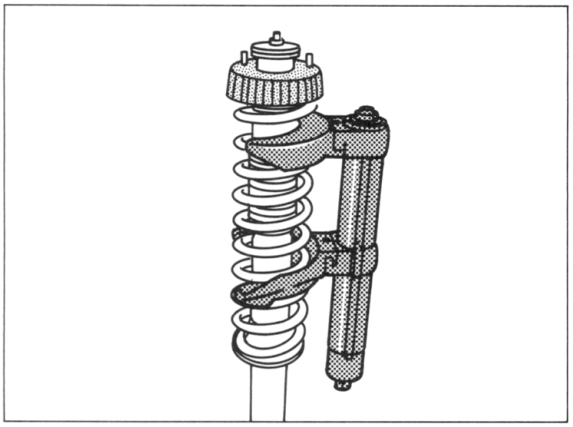
Dismantling and assembly notes

Dismantling

1. Preload coil spring with spring tensioner until the load is taken off the piston rod.



772-42

Note

As of MY '91, the following modified spring strut parts are used in conjunction with the lowered spring strut towers:

– vibration damper (length of container tube),

– coil spring,

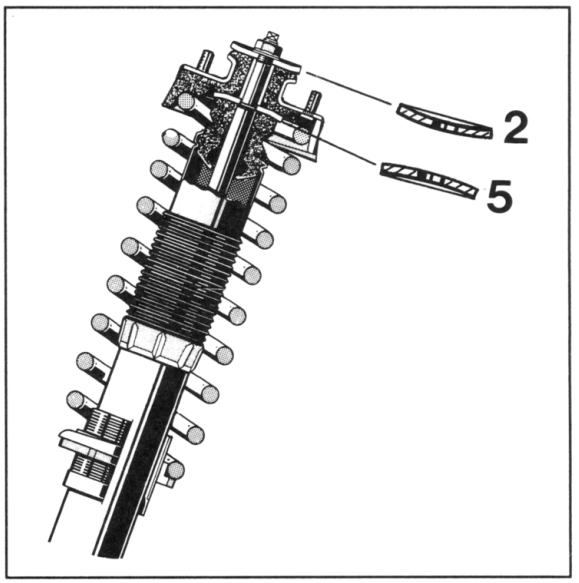
– protective bellows and auxiliary spring.

Assembly

It is recommended to replace the coil springs only in pairs.

When assembling, observe correct position of shock absorber eye (mounting at trailing arm) relative to strut mount.

Install washers No. 2 and No. 5 (only present with version B) in correct position.



1226-42

When fitting new parts that affect vehicle height, check alignment of front and rear axle.

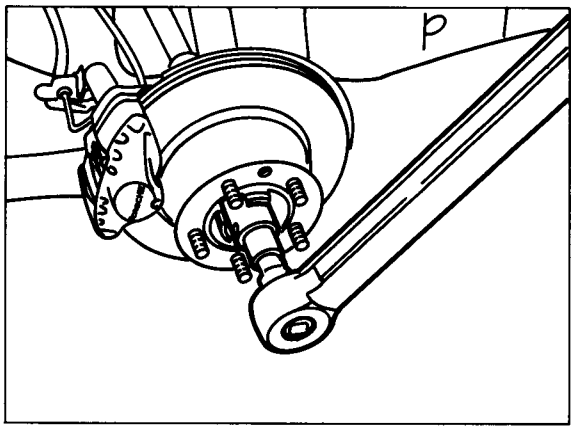
Removing and installing drive shaft

Removal

1. Remove wheel.

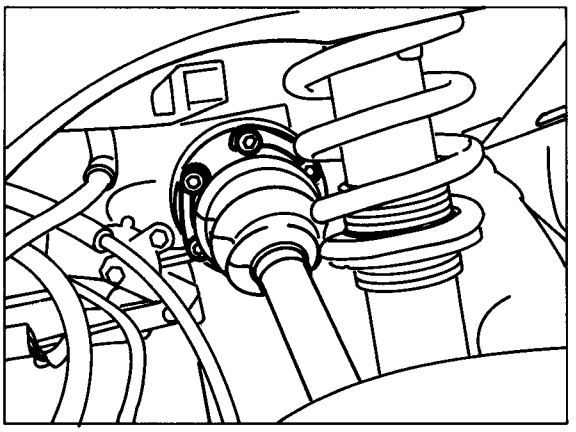
2. Remove underside panel.

3. Actuate parking brake and unbolt M 22 x 1.5 lock nut from drive shaft.



773-42

4. Unbolt drive shaft pan head screws from transmission flange.



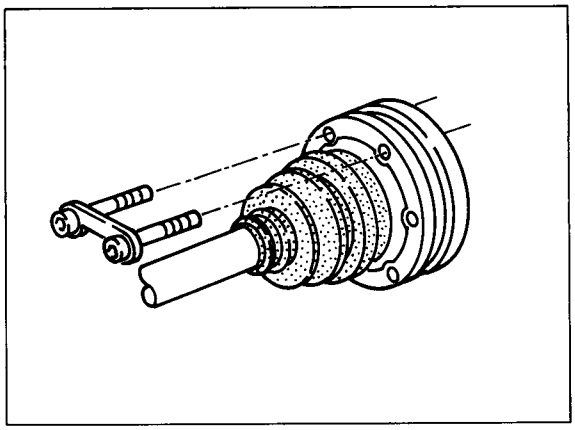
774-42

5. Pull out drive shaft in downward direction.

Installation

1. Coat teeth, thread and stem of drive shaft with Optimoly HT.

2. Put shims on pan head screws and coat threads lightly with Optimoly HT.
   Insert pan head screws with shims into drive shaft flange, making sure the flange cover is not greased inadvertently.



775-42

3. Introduce drive shaft and tighten pan-head screws to 42 Nm (31 ftlb) (M 8) or 80 Nm (59 ftlb) (M 10), respectively.

4. Coat seating surface of new M 22 x 1.5 lock nut with Optimoly HT and tighten to 460 Nm (339 ftlb).

5. Refit underside panel.

6. Fit wheel.

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Wheels and tires

Tire condition / tire pressure

Tires are safety-relevant items that are only capable of meeting the requirements imposed if they are run at the correct tire pressure and with sufficient tread depth.

The tire pressures indicated are minimum pressures. The tires must never be run at lower pressures since this affects roadholding adversely and may lead to severe tire damage.

Valve caps protect the valve against dust and dirt and therefore help prevent leaks. Always screw on caps tightly and replace missing caps.

For safety reasons, do not limit tire checks to checking the tire pressure but also check for sufficient tread depth, ingress of foreign matter, pinholes, cuts, tears and bulges in the sidewall (cord breakage)!

Tire pressure of cold tires (approx. 20°C) (summer and winter tires)

16 inch wheels	
front	2.5 bar pos. pressure
rear	3.0 bar pos. pressure
17 inch wheels	
front	2.5 bar pos. pressure
rear	2.5 bar pos. pressure
	3,0 bar pos. pressure with 275/35 ZR 17 tires
Collapsible spare tire	
front/rear	2.5 bar pos. pressure

Tire and wheel survey / tire specification character

For a tire and wheel surview for summer and winter tires, refer to the relevant Technical Information (TI), Group 4.

When replacing summer tires, check for the correct tire specification character. The specification characters N 2, N 1 or N 0, respectively, help to distinguish summer tires approved by Porsche from other versions of identical tire type and the same tire size. The tires approved by Porsche are also identified in the corresponding TI.

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Suspension alignment settings

The following specifications refer to the curb weight to DIN 70020. This means: Full fuel tank, spare tire and tools in vehicle.
Differing settings for U.S. vehicles are given in brackets.

Front axle

	Carrera 2/4	Turbo-Look America-Roadster	Carrera RS	Carrera RS America	Speedster
Height adjustm.* **mm**	165 ± 10 (175 ± 10)	165 ± 10 (175 ± 10)	125 ± 5	175 ± 10	165 ± 10 (175 ± 10)
max. left—to-right difference **mm**	10	10	5	10	10
Toe, unpressed (total)	+ 25' ± 5'	+ 25' ± 5'	+ 25' ± 5'	+ 15'± 5'**	+ 15' ± 5'
Toe difference angle at 20° steering lock Can be modified only by replacing the steering arms	- 40' ± 30'	- 1° 20' ± 30'	- 1° 50' ± 30'	- 40' ± 30'	- 40' ± 30'
Camber (with wheels in straight ahead position	0° ± 10'	0° ± 10'	- 1° ± 10'	- 15' ± 10'**	- 15' ± 10'
max. left-to-right difference	10'	"	"	"	"
Caster ***	4° 25' + 15' - 30'	"	"	"	"
max. left-to-right difference	15'	"	"		"

* From road surface contact area of wheel to outer mounting hex bolt - "Crossmember to body".

** Modified values that are also applicable retroactively.

*** The tolerance of the caster setting was changed during the 1992 MY from 4°25' ±15' to **4°25' (+ 15', – 30')**. The modified tolerance is also applicable retroactively.
The specified – max. left-hand to right-hand difference of 15' – remains valid.

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Rear axle

Differing settings for U.S. vehicles are given in brackets.

	Carrera 2/4	Turbo-Look America-Roadster	Carrera RS	Carrera RS America	Speedster
Height adjustment:					
From road contact surface to meas. point at control arm **mm**	258 ± 5 (268 ± 5)	258 ± 5 (268 ± 5)	223 ± 5	268 ± 5	258 ± 5 (268 ± 5)
From road contact surface to meas. point at outer control arm mount **mm** (body side)*	270 ± 5 (280 ± 5)	270 ± 5 (280 ± 5)	235 ± 5	280 ± 5	270 ± 5 (280 ± 5)
max. left-to-right difference **mm**	10	10	5	10	10
Toe-in per wheel	+ 10' ± 5'***	"	"	"	"
max. left-to-right difference	10'	"	"	"	"
Camber	- 40' ± 10'***	-45' ± 10' (- 45' max. – 55' min. – 15')	- 1° 15' ± 10'	- 45' max. - 55 min. - 15'**	- 45' ± 10' (- 45' max. - 55' min. - 15')
max. left-to-right difference	20'	"	"	"	"

* Use this measuring point if it is provided (refer to page 44 - 4).

** Modified values that are also applicable retroactively.

*** **Modified rear-axle settings** (camber and toe-in) for service. **Former settings:** Toe-in (per wheel) = + 15' ± 5' / camber = - 20' ± 10'
The **new values** are applicable **retroactively** to suspension alignment operations on all Carrera 2/4 vehicles from the start of production.

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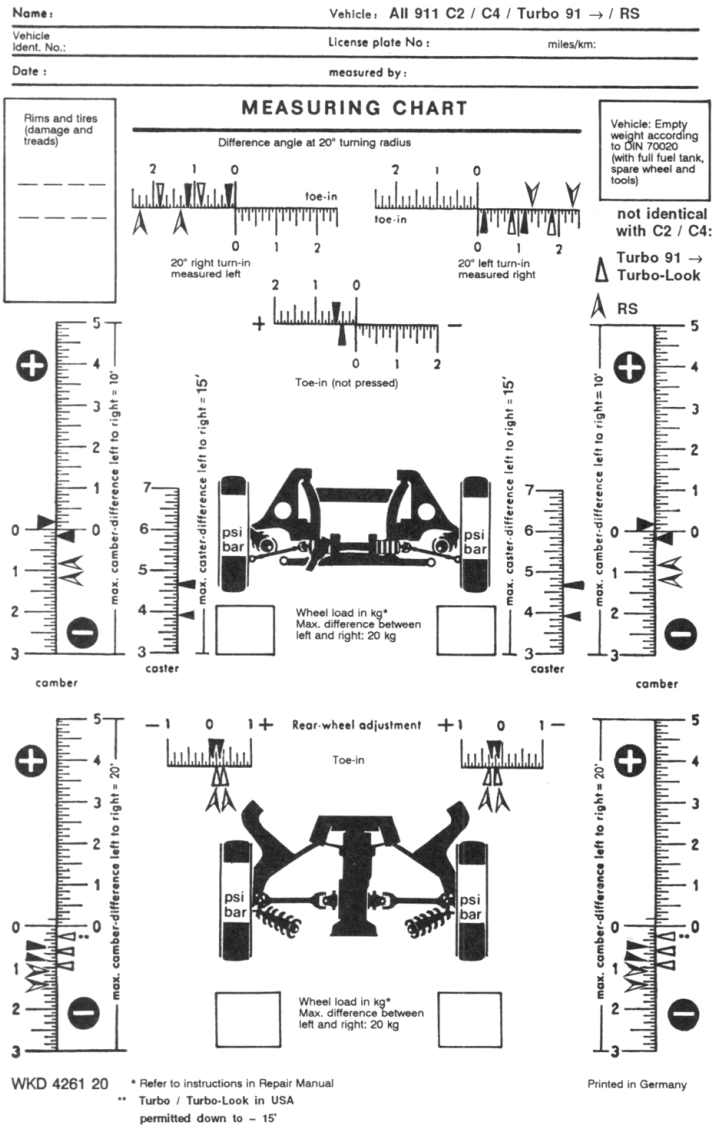
Sample measuring chart*

Note

The measuring chart is not applicable to the 911 RS America. Modify the measuring chart as required.

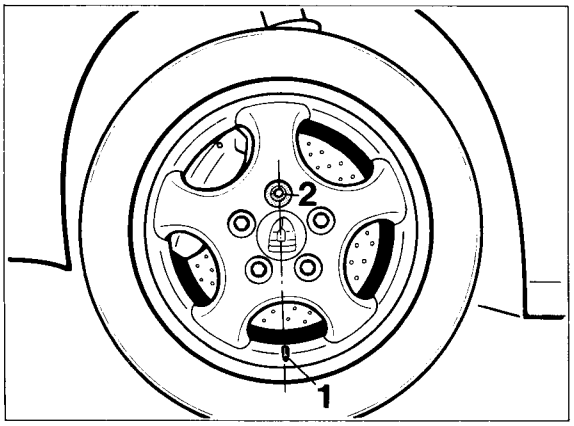


* The tolerance of the caster setting was changed during the 1992 MY from 4°25' ±15' to 4°25' (+ 15', - 30'). The modified tolerance is also applicable retroactively.
The specified maximum left-to-right difference of 15' remains valid.

Fitting 16" and 17" cup design wheels to the vehicle

In the case of the 16" and 17" cup design wheels, the valve (No. 1) and the locking wheel nut cannot be arranged on the same side (as on previous models).

For correct installation, the valve (No. 1) must face the color-coded stud (No. 2). Be sure to fit the locking wheel nut to the color-coded stud (No. 2).



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If required, mark the wheel stud located opposite the valve before removing the wheel.

For stationary balancing of the wheels (with step rings), turn the wheel in such a manner that the valve points to the bottom. Tighten the wheel in this position.
After balancing, mount the wheel to the vehicle in an identical position (valve faces to the bottom / color-coded wheel stud and locking wheel nut located on top).

Important note

Fitting (and tightening) procedures **of all other wheel types (16-inch Design 90 etc.)** for stationary balancing **remain unchanged.**

This means: Coded stud, valve and locking wheel nut are located on the same side. When tightening, valve must point up (same position as on balancing equipment).

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Wheel Alignment

Tools

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No.	Description	Special Tool	Order Number	Remarks
-	Excentric socket	9265	000.721.926.50	
-	Switchover socket-type ratchet	9265/1	000.721.926.51	

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Wheel Alignment

General Information

Wheel alignment is applicable for both the 911 Carrera 4 and 911 Carrera 2.

Check wheel alignment of a vehicle with an optical or electronic alignment tester. Procedures are described in the operating instructions supplied with a pertinent tester. The following requirements must be fulfilled prior to checking the wheel alignment.

- Vehicle at curb weight according to DIN 70020, which means a ready-to-drive vehicle with full fuel tank, spare wheel and tools.

- Correct joint and wheel bearing play (wheel bearing play cannot be adjusted).

- Specified tire inflation pressure; uniformly worn tire treads.

If both front and rear wheel alignment has to be checked, first check or adjust wheel positioning values on the rear axle.

It is recommended or necessary* to check the height adjustment at DIN curb weight before the wheel positioning values of the front and rear axles can be adjusted.

Left to right wheel load differences can be kept as small as possible due to the possibility of adjusting the car ride level height, insofar as wheel load scales are available. The wheel load difference is adjusted by changing the car ride level height within height tolerances. A small as possible left to right wheel load difference is preferred.

* After completion of work which caused changes in height or with a wrong height.

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Important Information for Working on Wheel Alignment of Vehicle

Conform with the following points when checking/adjusting wheel alignment.

Height Adjustment / Wheel Load Change

Changing the height on one side will simultaneously cause a change in wheel load.
A wheel load change on one wheel will also change the wheel loads of the other wheels.

Wheel loads are increased by increasing the installed spring preload on one side (vehicle lifted).

Wheel loads are reduced by reducing the installed spring preload on one side (vehicle lowered).

Wheel load changes are always transmitted diagonally to the other axle side. In other words, when the wheel load is reduced or increased on one wheel, the same thing happens on the diagonally opposite wheel.

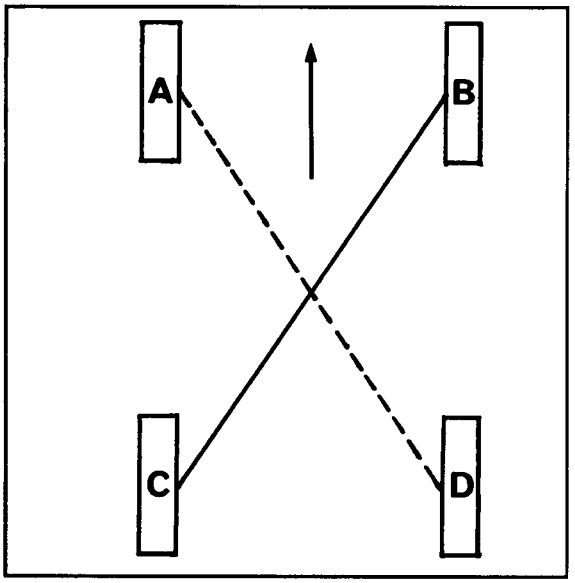
Example

Left rear spring preload C is increased.

This causes the wheel load

- to increase at left rear C and right front B and

- to decrease at right rear D and left front A.



44-3

The left to right wheel load difference should be as small as possible on the front and rear axles (less than 20 kg (44 lbs.) whenever possible).

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Checking / Adjusting Height

Note

Adjusting can be used to correct different left to right wheel loads. With correct ride level height the wheel load differences will be within permissible tolerances, insofar as coil springs have the same installed length (installed spring preload) on each axle.
Tolerances: ± 1mm.
Wheel load differences can be kept as small as possible in conjunction with wheel load scales. Left to tight tolerances on front and rear axles less than 20 kg (44 lbs.).

Park car on a level surface or test station to check the ride level height. Car ready-to-drive with full fuel tank, spare wheel and tools. Bottom the suspension at front and rear of car 2 or 3 times and let the springs return the car to its height.

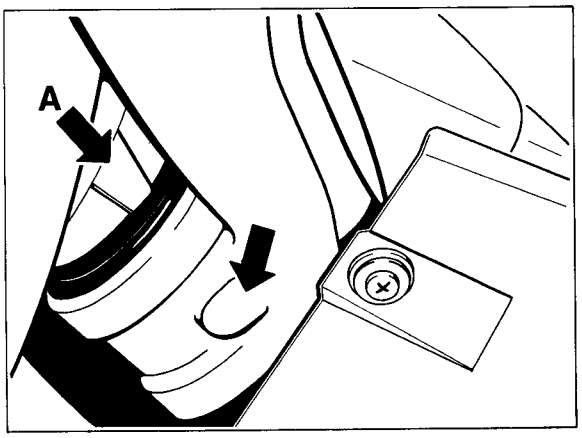
Front Axle

Measure the distance from the point of wheel/ floor contact to the outer cross member-to-body bolt head's lower edge.

See page 44 - 02 for front alxe (V) and rear axle (H) specifications.

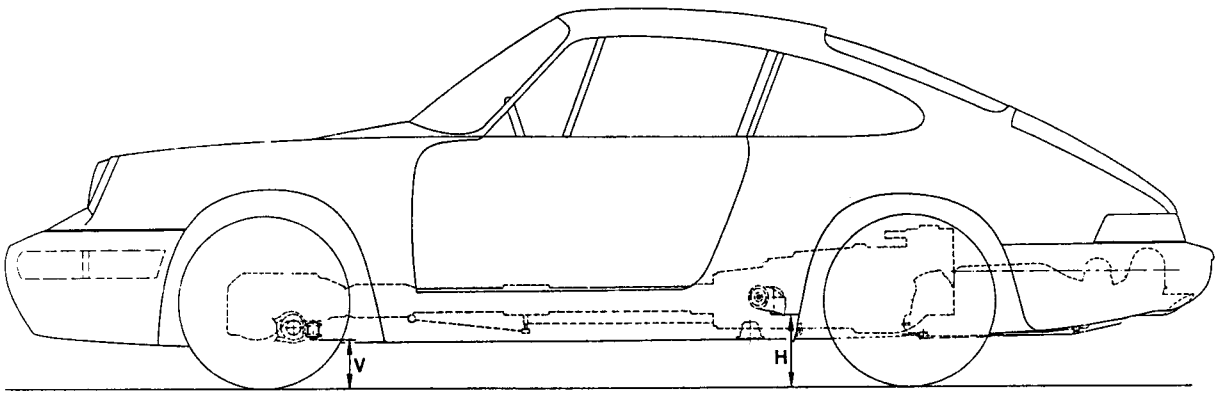
Rear Axle

Measure the distance from the point of wheel/ floor contact to the body end measuring surface on the outer arm mount (arrow with A). Some cars do not have this measuring surface. In such cases the cast boss on the rear axle arm (arrow without A) must be used as a measuring point.



The car ride level height is adjusted **on the rear and front axles** by turning the adjusting nut on the bottom spring retainers. Use a hook-type wrench or Special Tool VW 637/2 (lever) for this purpose.

Adjusting Nut
- turned clockwise = car higher
- turned counterclockwise = car lower



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Wheel Positioning

Notes

Check and adjust wheel positioning values only with the specified requirements (see General Information on page 44 - 2).

If front and rear wheel alignment of a car is to be checked, first check and adjust the rear axle.

Tighten the corresponding bolts or nuts with specified torque (see tables in Repair Groups 40 and 42) after adjusting.

Front Axle

Prepare the car for checking and adjusting of the wheel positioning values. Place front wheels on rotating plates or something similar. Bottom front and rear wheel suspension of car 2 or 3 times and have spring force move the car up to ride level height each time.

Adjusting Camber

Camber is adjusted by displacing the spring strut to the wheel carrier. This requires unscrewing two mounting bolts with Special Tool 9265/1.

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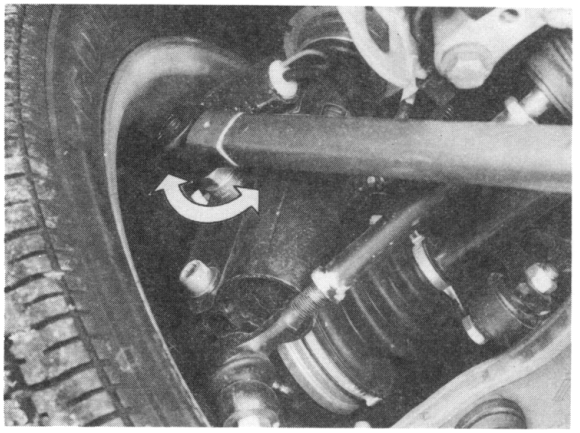
Apply excentric socket 9265 on the upper mounting bolt head (fillister head bolt) and turn to adjust the camber.



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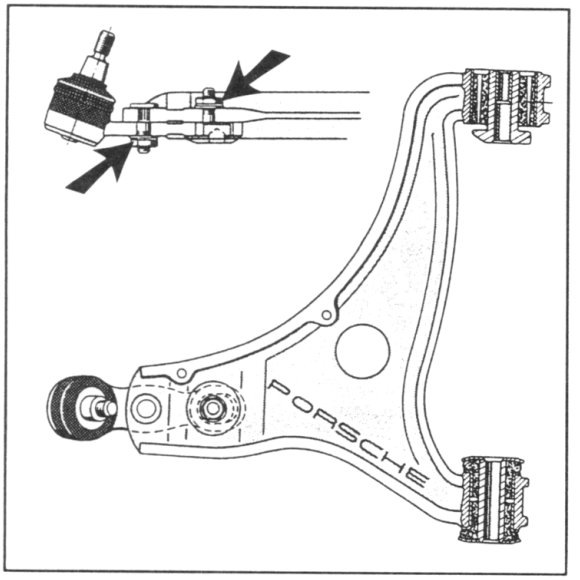
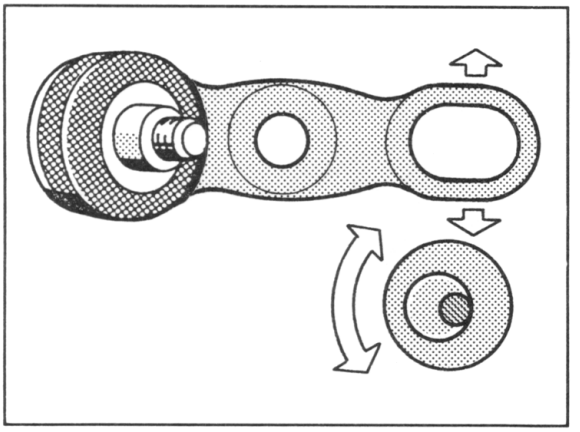
Adjusting Caster

Unscrew bolted connection between link carrier and control arm (arrows).



694

Adjust caster by turning the caster excentric and therefore displacing the link carrier forward or back.



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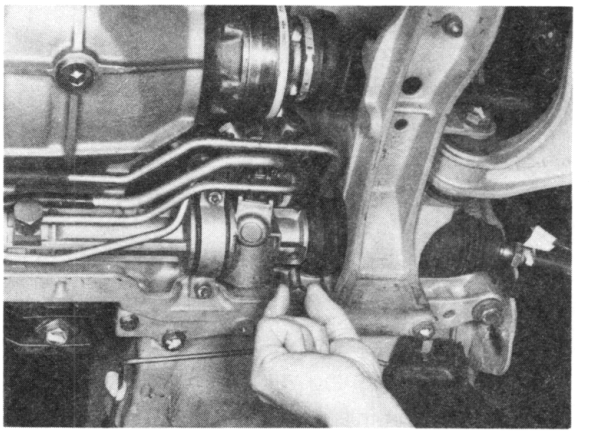
Adjusting Toe

Preparation: Check whether steering wheel is offset to the steering gear. This requires removing the floor trim panel and centering the steering gear in middle position with Special Tool 9116. Attempt to have the best value when transferring the steering wheel, if necessary.
Remove Special Tool 9116 afterwards.



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Clamp steering wheel in the middle position with the steering wheel holder and adjust toe on the tie rods.
Make sure the bellows in question is **not twisted** (damaged).

Note

After tightening the tie-rod lock nuts, the **tie-rod ends** of both tie-rods must be **in a horizontal position**.
The bellows on the tie-rods must **not be twisted**. Check and turn bellows into correct position if required.
A **damaged** bellows must be **replaced** as the steering gear may otherwise be damaged by dirt ingress.

Toe Difference Angle

The toe difference angle cannot be adjusted (it can only be influenced by replacing the steering arms).

Rear Axle

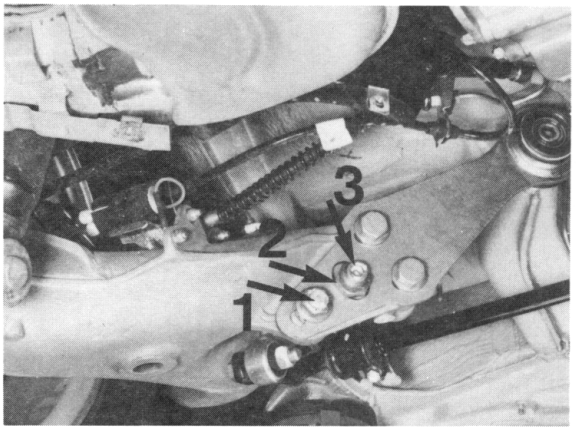
Adjusting Camber and Toe

Remove rear floor trim panel.

Unscrew spring strut and arm bolted connection.

Bottom front and rear wheel suspension of car 2 or 3 times and allow the spring force to raise the car to the ride level height each time.

Camber is adjusted by turning excenter 1 and toe by turning excenter 2.



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1 Camber excenter = adjustment via hexagon socket (arm end)

2 Toe excenter = adjustment via hexagon

3 Toe excenter mounting screw

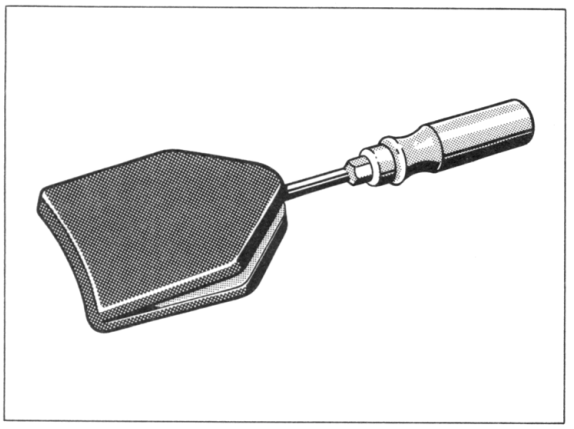
Tire fitting

The following assembly and dismantling procedures refer to the 17-inch Cup and Cup Design wheels with asymmetric hump.

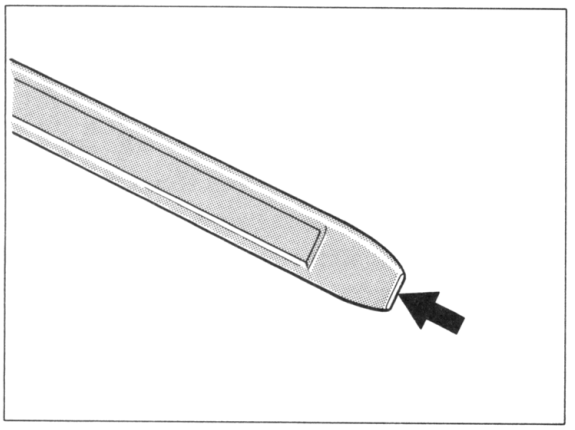
Notes / tools

– For mag wheels (911 Carrera RS), pay particular attention so as not to damage the paintwork, including the hump area. If required, cover the rim flange with adhesive tape after the pressing off stage.

– To remove / fit a tire, a tie-down tool – Special Tool 9539 – is required. In addition, the tire lever should be flattened along its front face and should then be rounded (arrow).



1012 - 44

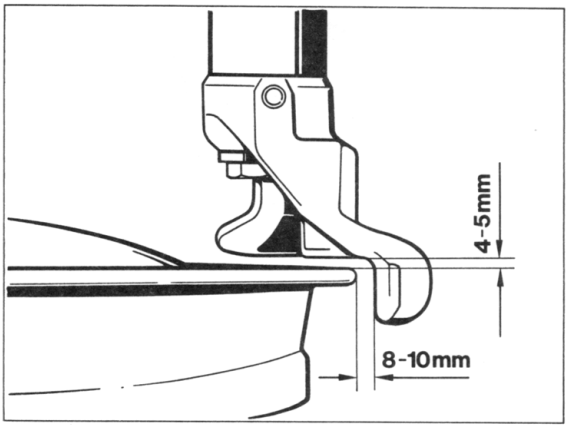


1013 - 44

Tire assembly

– Fit wheel to assembly stand and coat inside of wheel and both tire beads with tire assembly compound.
Replace the valve whenever a tire is fitted or refitted.
Note
Recommended tire assembly compound: Use only Contifix **or** TIP TOP Universal, Part No. 593 0601 (3.5 kg can).

– Set assembly tool to correct clearance.



1014 - 44

– Fit first tire bead in the usual manner.

Note

The asymmetric hump changes its cross-section across the circumference.
The following points must therefore be observed when fitting or removing a tire.

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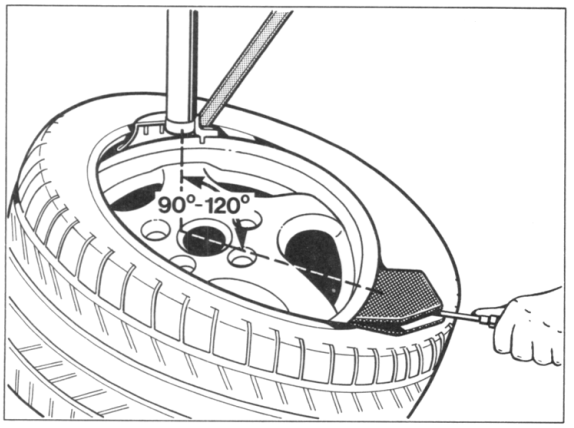
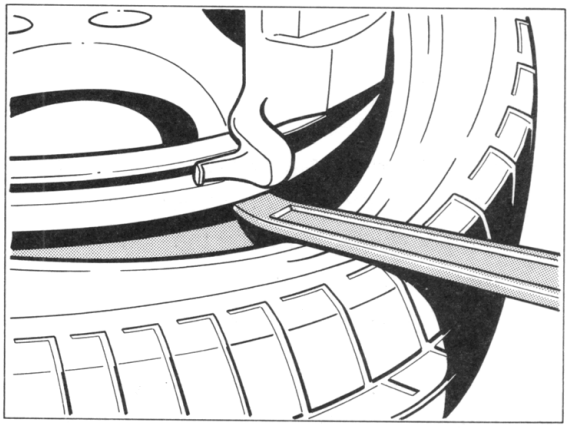
– When starting to fit the **second bead,** the assembly arm should be located **opposite the valve.** Then place the second bead as flat as possible onto the wheel, guide it across the assembly head and tie it down with Special Tool 9539, keeping it offset by approx. 90 to 120 deg.

While performing the turning motion and fitting the **second bead,** use a second tire lever and Special Tool 9539 to locate the tire bead in the drop center.



1015 - 44

– When combining 255/40 17-inch tires with 8-inch wheels, the additional tire level must be placed below the hump.



1016 - 44

– **When inflating the tire, the beads must jump over the hump at a positive pressure of 4.5 bar at the latest.**
The bead still located in the drop center must therefore be positioned **opposite the valve (flatter hump section)** when the tire is pumped up. If required, rotate the tire accordingly and coat with assembly compound again.

Removing the tire

– Adjust assembly head as for tire fitting (Fig. 1014 - 44).

– **When pressing off the tire, start at the valve since the levering force required in this area is somewhat lower.**
Then press off the tire on both sides, coating the rim flange with assembly compound.

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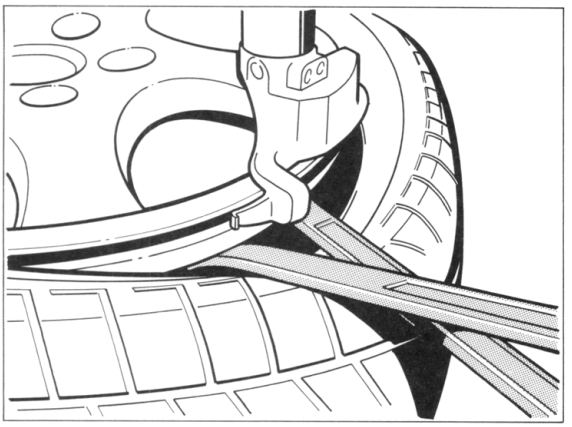
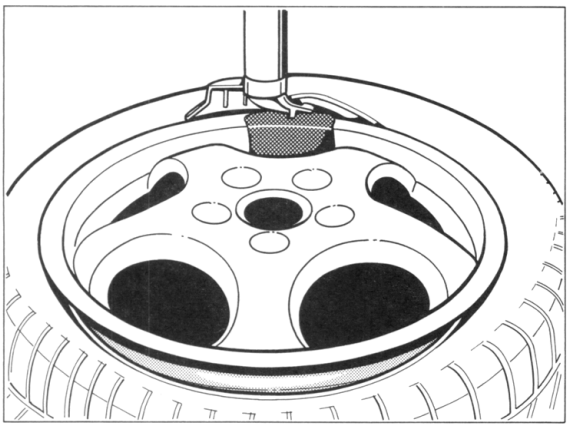
– **Lift the first side of the tire** over the assembly head (Fig. 1017 - 44). Place a rag or a leather cloth between the wheel and the tire lever.
In addition, make sure the tire remains in the drop center opposite the disassembly head (Fig. 1018 - 44). Use Special Tool 9539 to facilitate this.



1017-44



1018-44

– **Remove the second side of the tire** in the usual manner.

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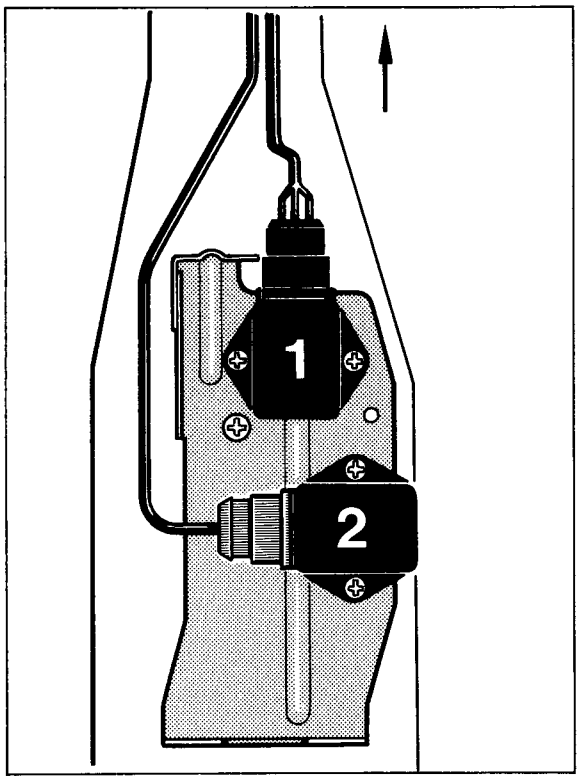
Axial and Lateral Acceleration Sensors

Location

The sensors are installed on a sheet metal console on the tunnel underneath the center console. These sensors are required for all wheel drive and antiblock systems.

1 - Lateral acceleration sensor

2 - Axial acceleration sensor



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Installation

Always conform with the following points when installing.

1. Park car on level ground (level floor).

2. Check levelness of the sheet metal console with a bubble level. Replace a bent sheet metal console.

3. Connecting leads must **not** be mixed up. Plug receptacles have different colors for identification.
   Black plug receptacle for the lateral acceleration sensor.
   Gray plug receptacle for the axial acceleration sensor.

4. Sensors must not be subjected to any type of extreme acceleration such as from throwing, falling or knocking.

5. Sensors must always be inspected after an accident. Sensors must be replaced if they are not within specifications.

Checking

Checking Information:

Checking is required to guarantee the following points.

- Correct location (position) of sensors

- Function of sensors

- Electric leads (plugs) connected on the correct sensor (mix-up test)

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Testing requires use of a 55-pin ABS 2 - LED adapter lead (see point 1.), multimeter, garage jack and measuring tape. The 55-pin adapter lead, which is required for the ABS test of Carrera 4 models (instead of the 35-pin adapter lead), has 3 outlets which were integrated for testing of axial and lateral acceleration sensors.

Manufacturer of Adapter Lead:

Robert Bosch GmbH
Dept.: KH/VKD 3
P. O. Box 41 09 60
D-7500 Karlsruhe 41
Phone: 0721/4009-1
Telex: 78 26 663

Suppliers of Adapter Lead:

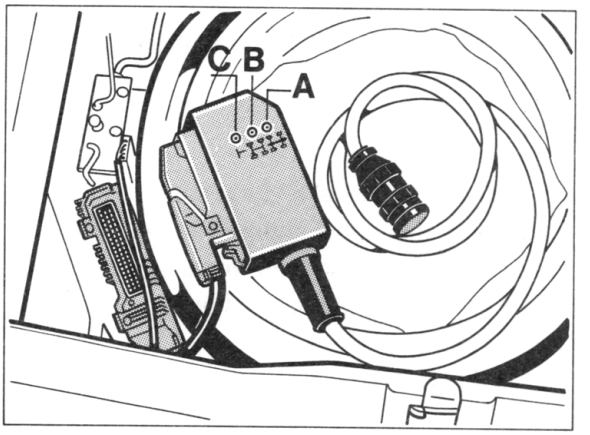
Authorized Dealers
Order No. KDAS 0003/7

1. Turn off the ignition, disconnect ABS/PDAS control unit plug on the control unit and connect it with the 55-pin ABS 2 - LED adapter lead.

Note

The following tests are possible with or without a connected ABS 2 - LED tester. The three outlets are marked with symbols.

A = Signal from axial acceleration sensor
B = Signal from lateral acceleration sensor
C = Ground for both sensors



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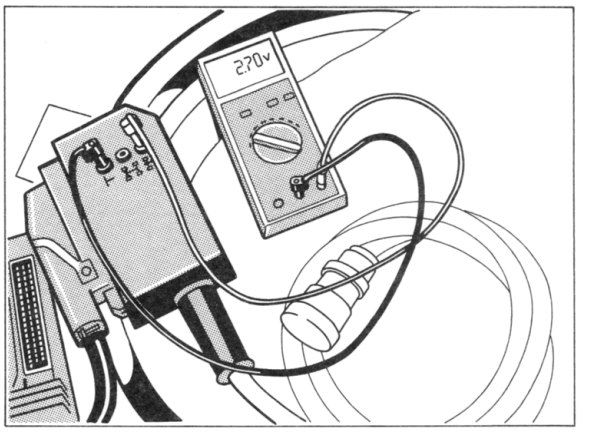
2. Measure and note the voltage values from the axial acceleration sensor and lateral acceleration sensor with the car in normal position and the ignition turned on.
Specification: 2.7 ± 0.14 volts.
Normal position means that the car is on a level surface. If the car had been lifted previously and if necessary, take stress out of the wheel suspension (move car several meters and bottom the front and rear wheel suspension several times).
Continue with the Evaluation Table at the end of this section if the value deviates from specifications.



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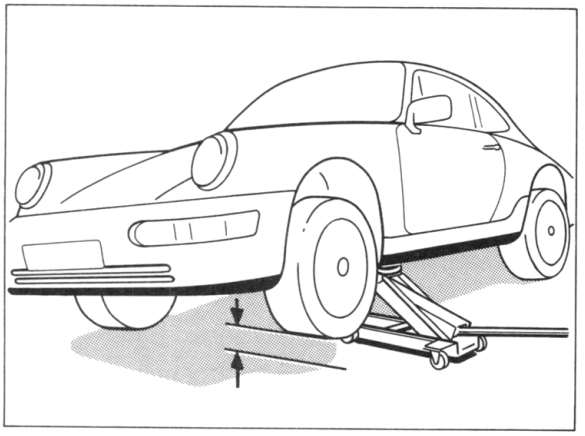
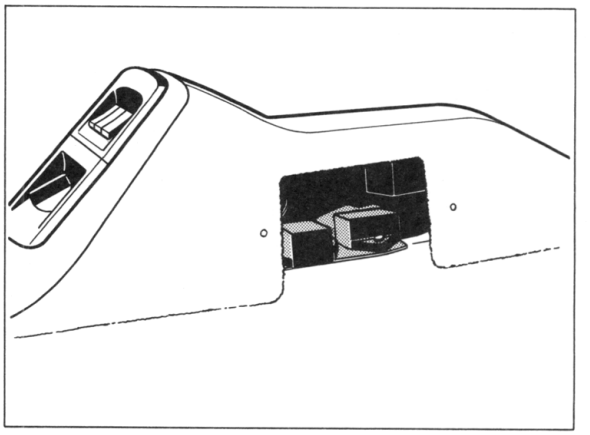
3. Provide about 150 mm ground clearance on the left front wheel by lifting the car on the left front car jack take-up point. Read and note voltage values of the sensors.



293 - 45

Note

A cover is located on the right-hand side of the center console and must be removed to have access to the sensors.



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4. Lower left front side of car again.
Lift car at right front afterwards in the same manner and also about 150 mm.
Read and note voltage values of the sensors.

5. **Evaluate the values with help of the following table. If applicable, eliminate any faults.**

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Evaluation Table for Sensor Test

Tested / Information	Requirements Fault / Fault Elimination
Installed position of sensors by way of the output voltage Sensors receive an input voltage of 5 V from the ABS / PDAS control unit. Output voltage is 2.7 V insofar as the sensor is in horizontal position and in perfect condition.	- **Specifications:** **2.7 ± 0.14 volts for a stationary car on a level surface (ignition turned on).** Test value above or below specified value = bent sensor console or faulty sensor. No voltage displayed = break in electric leads or faulty sensor. If applicable, check electric leads according to the wiring diagram. Certain faults (breaks / shorts / faulty sensor) are stored in the fault memory of the ABS/PDAS control unit. Consequently always read out and, if applicable, cancel the fault memory with a 9288 System Tester after elimination of faults (see page 39/45-1).
Sensor function / mix-up test Test by lifting car approx. 150 mm each 1 x right front and 1 x left front. This ust produce a precisely defined change in voltage. Use the above mentioned test (output voltage for a car on level surface) as a reference value.	- **Axial acceleration sensor** Specifications: **The output voltage must change in the direction of less voltage** when lifting the car at right front and left front. Example: Output voltage 2.73 V Left front lifted 2.63 V Right front lifted 2.62 V - **Lateral acceleration sensor** Specifications: With the output voltage value as a basis **there must be greater voltage when lifting at left front and less voltage when lifting at right front.** Example: Output voltage 2.71 V Left front lifted 2.91 V Right front lifted 2.50 V

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Tested / Information	Requirements Fault / Fault Elimination
Always check the symbols (identification for axial acceleration sensor and lateral acceleration sensor) on the adapter plug (mix-up test).	- **Electric lead plugs are mixed up on the sensors**, if the voltage changes in direction of more and in direction of less voltage (as should be on the lateral acceleration sensor) when testing the axial acceleration sensor (lifted 1 x left and 1 x right). See page 45 - 1 for cross reference. The pertinent sensor has a fault, if there is no change in voltage while lifting (left and right lifted the same distance). Eliminate the fault and then read out and, if applicable, cancel the fault memory with a 9288 System Tester.

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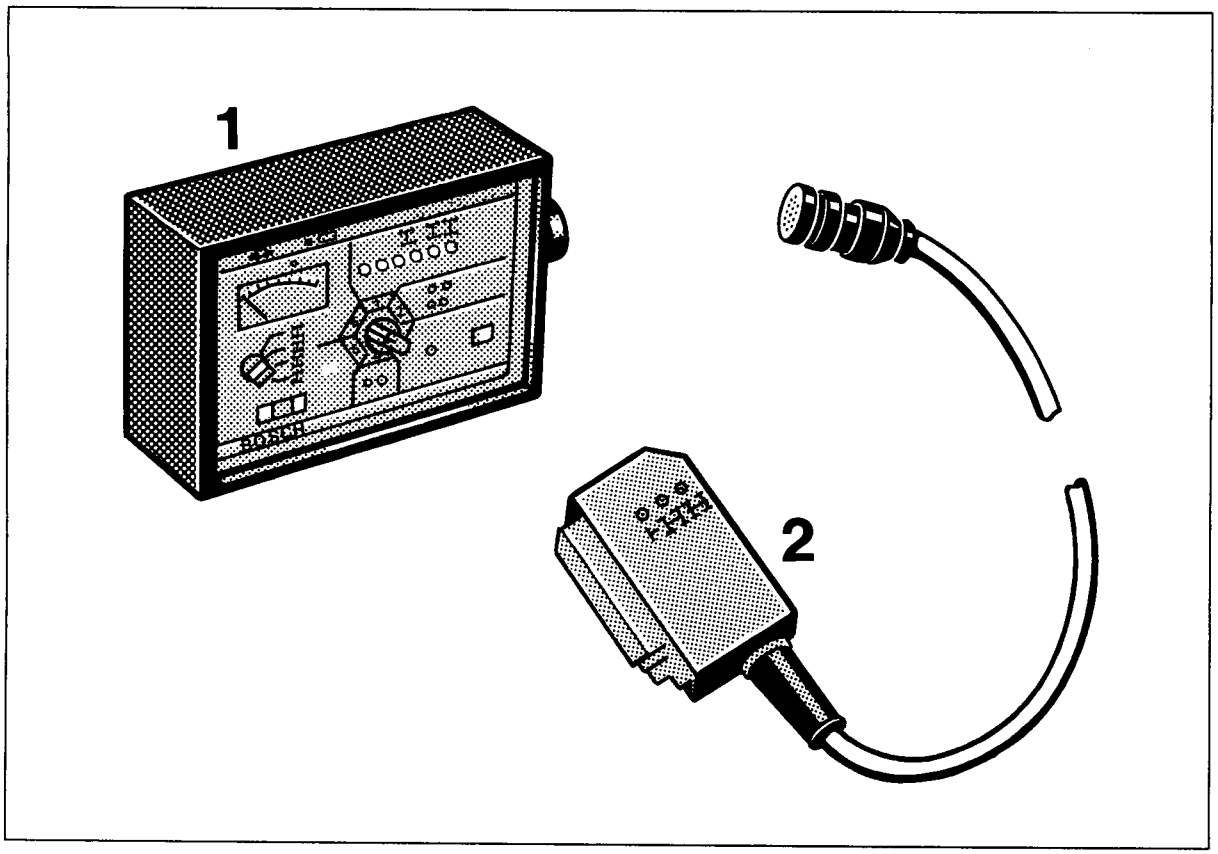
Testing ABS in 911 Carrera 4 with ABS 2-LED Tester

Important information on ABS of 911 Carrera 4

1. If any work is carried out on the hydraulic unit, speed sensors or cable harness, or if any units are replaced, e.g. during accident repairs, **a function check with the ABS Tester must be performed.** This prevents any mixing up of the electrical and hydraulic lines and ensures that the hydraulic unit functions correctly.

2. If a fault is indicated during operation (without any prior assembly work), diagnosing and trouble-shooting with System Tester 9288 is possible.
   In this case select system PDAS and read the fault memory.

Tools



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Tools

No.	Designation	Special tool	Order number	Explanation
1	ABS 2-LED Tester		KDAS 0003	**Manufacturer** Robert Bosch GmbH Abt.: KH/VKD 3 Postfach 41 09 60 7500 Karlsruhe 41 Telephone: 0721/4009-1 Telex: 78 26 663 **Supplier** Authorized dealer or agent
2	55-pole ABS 2-LED adapter cable		KDAS 0003/7	Same manufacturer and supplier as No. 1 Other possible applications of adapter cable: – on the 911 Carrera 4 for checking longitudinal and transverse acceleration sensors – on the 928 with PSD for checking ABS and transverse acceleration sensor

Printed in Germany – VII, 1990

PDAS diagnosis/Troubleshooting

Contents

Printed in Germany - VII, 1990

Overview of diagnosis/troubleshooting on PDAS and ABS

General

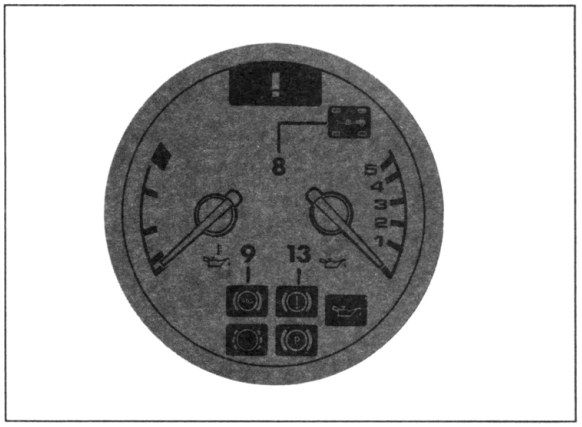
PDAS (Porsche Dynamic All-wheel Control) operates in conjunction with the ABS (Anti Block System).
Several test operations with different testers and special tools are required for complete testing of PDAS and ABS.

It is possible to define the procedure in the event of faults or irregularities by making use of the following overview.

The page number or repair group for the following test points is specified in the table of contents on P. D39/45-1.

Overview

Test point	Notes
Test point 1	
PDAS diagnosis with system tester 9288	If a fault is indicated by the PDAS/ABS warning lamp (No. 8 / No. 9) and irregularities are suspected, first read out the fault memory of the PDAS/ABS control unit. If No. 13 (brake pressure warning lamp) and No. 8 light up although the engine has been running for longer than 1 minute, there is a fault in the booster circuit (test point 6 or troubleshooting in accordance with circuit diagram).



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Test point	Notes
Test point 2	
Bleeding condition of the lock control (post-bleeding the hydraulics of the lock actuation system)	The control quality of the lock depends greatly on the bleeding condition. A relevant test with workshop equipment is not possible. For this reason, post-bleed in cases of doubt (Page 47-5).
Test point 3	
Measuring the disk wear on the longitudinal and transverse locks	Measure the thickness of the disk assemblies in built-in condition using a lock measuring cylinder (special tool 9514).
Test point 4	
Checking the locking torque (friction coefficients) of the longitudinal and transverse locks	In the event of functional problems or irregularities, perform or verify test points 1, 2 and 3 before the locking torque test (locking torque in relation to pressure). This means: – No fault stored in the control unit fault memory t – Perfect bleeding condition of the lock control – Thickness of the disk assemblies ok (wear assessment) If the friction coefficient curves deviate from the setpoint in the locking torque test, the lock is not functioning optimally. Only a large deviation of the actual value from the setpoint is stored as a system deviation in the control unit fault memory. When performing the locking torque test, check the pre-pressure valves in the lock hydraulics (lock actuation system) as well (test point 5).

Test point	Notes
Test point 5	
Checking the pre-pressure valves in the lock hydraulics (lock actuation system)	A pre-pressure valve is installed in the pressure line before every lock cylinder. This holds a residual pressure for play compensation and to ensure dynamic driving response.
Test point 6	
Pressure test on the booster circuit (brake booster and lock control)	The following are tested: – Freedom from leaks of the booster circuit – Pressure accumulator (gas charging pressure) – Switching points for the booster circuit (brake pressure warning lamp No. 13 and operating pressure) Brake pressure warning lamp No. 13, refer to Page D39/45-3 under test point 1. Frequent operation of the pressure pump: It is normal for the pressure pump (pump assembly) to start running after every 2nd or 3rd braking operation.
Test point 7	
Longitudinal and transverse acceleration sensors	This test serves the purpose of verifying the following points: – Correct installation position of the sensors – Function of the sensors – Connecting cables (connectors) plugged onto the correct sensor in each case (confusion check) **The sensors can be damaged by extreme acceleration (throw-fall-shock stressing) or extreme deceleration (accident).** **A sensor test must be performed in such a case and after repair work (removal and installation) (P. 45-1)**

Test point	Notes
Test point 8	
Preventing confusion of of longitudinal and transverse lock lines (hydraulic and electric)	This test tensures that in each case the right lock is operated following activation from the control unit. Electrical lines from the control unit to the valve block (longitudinal and transverse lock solenoid valves), or hydraulic lines (pressure lines) from the valve block to the lock cylinders could be mixed up. This could for instance occur following an accident repair involving corresponding removal and reassembly work.
Test point 9	
ABS test	If a fault is indicated by the PDAS/ABS warning lamp, first read out the control unit fault memory with the system tester 9288. To remedy the fault, use the ABS 2-LED tester in conjunction with the 55-pole adapter cable if necessary. The adapter cable is also used for sensor testing. After repair work on ABS components (as known from 944 and 928), perform a test with the ABS 2-LED tester under all circumstances.

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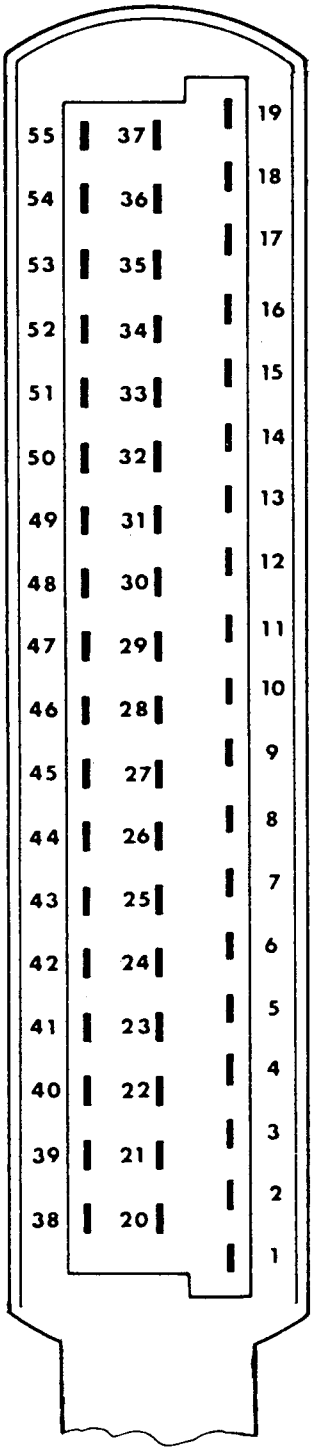
Connector assignment of PDAS/ABS control unit connector

Note: Equip 2 control unit connector auxiliary leads (self-made) with 2 tab connectors N 17.457.2 so that the connector contacts in the device plug are not damaged during the test.

1 Voltage, terminal 15
2 Operation of ABS rear axle solenoid valve
3 Ground, ABS solenoid valve, front right
4 K-lead from diagnosis
5 Operation of pump motor relay on hydraulic assembly
6 Free
7 Operation of valve relay on hydraulic assembly
8 Free
9 Ground of acceleration sensors
10 Speed sensor output at rear right for rear spoiler auxiliary control unit
11 Voltage, terminal 30
12 Free
13 Signal from longitudinal acceleration sensor
14 Free
15 Voltage supply (+5V) for acceleration sensors
16 Free
17 Monitoring, voltage supply for ABS solenoid valves
18 Operation of longitudinal lock solenoid valve
19 Operation of ABS solenoid valve, front left
20 Voltage for valve and motor relays on hydraulic assembly
21 Operation of transverse lock solenoid valve
22 Operation of ABS solenoid valve, front right
23 Monitoring of voltage supply for lock solenoid valves
24 Operation of ABS warning lamp
25 Free



26 Free
27 D+
28 Full-lock switch
29 Brake light switch
30 L-lead from diagnosis
31 Pump motor monitoring (hydraulic assembly)
32 Free
33 Free
34 Signal from transverse acceleration sensor
35 Operation of lock warning lamp
36 Free
37 Ground, ABS solenoid valves, front left + rear axle
38 Free
39 Free
40 Pilot lamp for lock function at full-lock switch
41 Free
42 Ground, shield, speed sensor at rear right
43 Signal, speed sensor at rear right
44 Ground, shield, speed sensor at rear left
45 Signal, speed sensor at rear left
46 Ground, shield, speed sensor at front right
47 Signal, speed sensor at front right
48 Ground, shield, speed sensor at front left
49 Free
50 Free
51 Signal, speed sensor at front left
52 Electronics ground
53 Free
54 Free
55 Free

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Important vehicle information

- Always turn off the ignition or disconnect the battery for resistance measurements (if this is not done, the measuring device could be destroyed).
- Disconnect the control unit connector from the control unit only when the ignition is switched off.
- Do not disconnect the battery when the engine is running.
- Never use a starting aid with more than 16 V or a boost battery charger.
- Depressurize the system first when working on the lock hydraulics.
- If the battery has been disconnected, system adaption must be performed subsequently (DME menu-system adaption).

- Brake test:

It is possible to test braking efficiency on a single-roller test stand with switched-off ignition. The roller speed must, however, be below 13 km/h.
In order to obtain sufficient brake force boosting, the brake must be operated as often as required directly before the test with the ignition switched on until the hydraulic pump starts running and fills up the pressure accumulator. Approx. 3...5 braking operations are then possible on the test stand with **the ignition switched off**.

- Towing: **Permitted only on all 4 wheels**

Legal regulations which deal with towing must be observed.
Switch on the ignition for this purpose.
The traction program must be switched off. To check this, turn the full-lock switch (traction switch in the center console) to the left.
Use the screw-in towing lug supplied with the vehicle tools.

PDAS diagnosis with system tester 9288

General

The PDAS/ABS control unit is capable of self-diagnosis. In other words, the control unit can detect, store and output certain faults from the PDAS and ABS.

Diagnosis is performed with the system tester 9288. The tester 9268 cannot be used.

Continuous positive is present at the PDAS/ABS control unit so that faults which have been detected and stored are not cleared when the ignition is switched off.

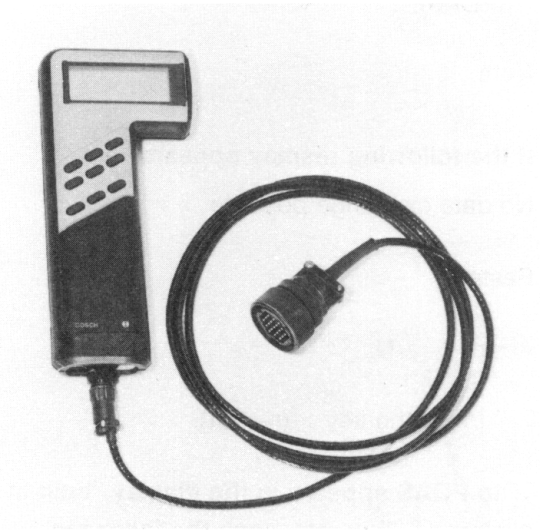
Possible uses of the system tester 9288 for PDAS

- Reading out the fault memory, clearing the fault memory
- Bleeding the locks (Rep. Gr. 47)
- Testing the longitudinal and transverse locks (locking torque)
- Testing the full-lock switch (traction switch in the center console)

Connection of the 9288 and procedure

Note
PDAS diagnosis with the system tester 9288 must be performed with the ignition switched on and the vehicle stationary.

1. Tester 9288 in conjunction with connecting cable 9288/1 (adapter cable)



Connect at the diagnosis socket in the passenger footwell (under the cover).

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2. **Switch on ignition and tester. It is possible to switch on the tester by means of any key. The operating instructions of the tester 9288 are contained in Repair Group 03.**

3. Select vehicle type and then the system (PDAS).

Note

If the following display appears:

No data exchange possible

Restart: >

Abort: N

- Press the key > (restart).

If no PDAS appears in the display "built-in systems ", this may have the following cause:

- Engine running
- Voltage supply for the control unit interrupted
- Ground missing
- K-lead or L-lead from diagnosis unit not ok
- Control unit faulty

4. Menu selection

Possible PDAS menus/explanation

1 = Fault memory
Read out fault memory/
fault elimination
Clear fault memory

2 = Drive links
Bleed
Testing transverse lock
Testing longitudinal lock

3 = Input signals
Full-lock switch test
(Traction switch in center console)

5. Information on desired menu
Menu 1 = Fault memory:
As from page D39/45-12
Menu 2 = Drive links
Bleeding: in repair group 47
Testing transverse and longitudinal locks:
Test point 4, refer to P. D39/45-1 (next supplement)
Menu 3 = Input signals
Full-lock switch test:
Next supplement for troubleshooting under No. 19 (troubleshooting No. 1 as from page D39/45-13).

Important information on diagnosis/troubleshooting with the system tester 9288

A precondition for troubleshooting is that the test person

- knows the positions of the components as well as the functions and technical relationships of the systems to be tested (model information)
- can read and evaluate Porsche circuit diagrams
- knows the functions of circuits and relays
- knows how to operate and evaluate test devices such as oscilloscopes, voltmeters, ohmmeters and ammeters.

Important:

If the control unit connector or battery is disconnected, the fault memory will be cleared.

If the battery is disconnectd, system adaption of the DME is also cleared.

The fault text in the display does not necessarily point to a fault in this component, but may also indicate a fault in the corresponding control unit and the connecting leads (paths) between the components and control unit.

No troubleshooting in the form of connector disconnection etc. must be performed before reading out the fault memory, because this may be stored as a fault in the fault memory.

Information on fault display

If fault not present appears on the tester display, this may mean:

- Fault not present at the time of testing (loose contact)
  Remedy: Check the fault path. In other words, perform a visual inspection of the wiring harness and plug-in connection.
- Test conditions under which the faults occurred are not satisfied (e.g., test speed is not reached)
  Remedy: Satisfy the conditions

Signal not plausible:

The signal of the monitored component does not fit in the tolerance band of the calculated value in the control unit

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Fault memory: Possible fault display/troubleshooting

Possible fault display

A maximum of 3 faults can be stored in the fault memory.

1:Transverse lock Valve	8:ABS Speed sensor rear right	15:Longitudinal lock valve
2:Transverse accel. sensor short/open circuit	9:ABS Speed sensor rear left	16:Longitudinal accel. sensor short/open circuit
3:Transverse accel. sensor Signal not plausible	10:ABS valve front left	17:Longitudinal accel. sensor Signal not plausible
4:Regulating tolerance transverse lock	11:ABS valve front right	18:Regulating tolerance longitudinal lock
5:Control unit faulty	12:ABS valve rear axle	19:Full-lock switch
6:ABS Speed sensor front left	13:Valve relay	
7:ABS Speed sensor front right	14:Return pump	

Fault indication / Troubleshooting

Important notes

If warning displays and faults are shown in the PDAS/ABS or other fault memories, they may have been triggered off by the following interference:

- Interference to electronic components or the car's electrical system caused by the ignition current or sparks at gaps in the ignition circuit (incorrectly assembled or loose spark plug caps or damaged ignition leads).
  Please refer to Technical Information Group 2 No. 5/89.

- Contact resistance caused by poor earth/ground connections, leading to differences in potential or inadequate screening of speed sensors.
  The poor earth/ground connection may not only occur at the affected components but also at other important earthing/grounding points.

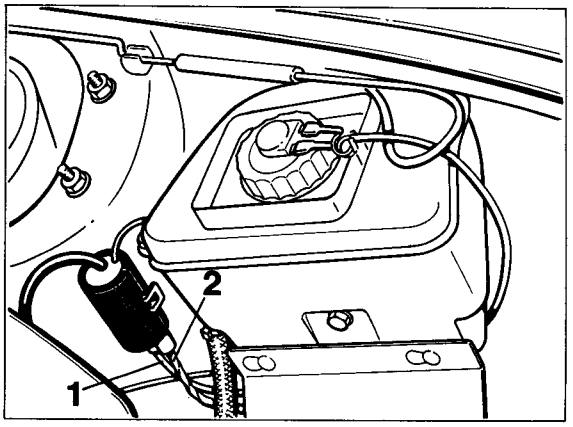
Troubleshooting aids

When measuring with the multimeter at the control-unit plug, make up 1 or 2 temporary leads in your own workshop, each with 2 flat pin plugs No. 17.457.2, to avoid damaging the plug contacts in the control-unit plug during the test.

Exchanging assemblies

Hydraulic unit: After installing/bleeding, carry out a complete ABS test with the ABS 2-LED tester.
Locking valve block: After installing/bleeding, carry out a check on the front-rear and lateral differential locks to ensure that the connections have not been accidentally interchanged.

Combined plug connections - distinguishing between wires



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In the brake pad wear and speed sensor wiring there are several combined plug connections of similar pattern. In this area, the wires can be distinguished as follows:

Screened wires (1) for the speed sensors.
2 wires with a protective tube (2) for brake pad wear.

Trial drive after eliminating fault

Erase the contents of the fault memory after the fault has been eliminated. Try the car out, then read out the fault memory again.

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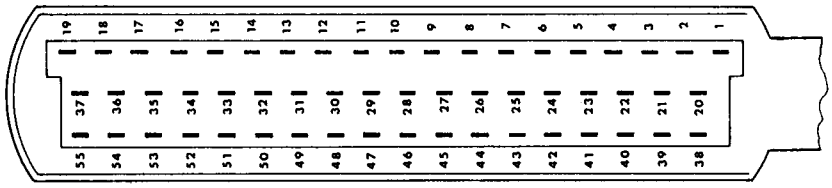
Fault, Fault Code	Possible Causes, Elimination, Remarks
1: Lateral lock valve Fault code - 11 -	No feedback signal from valve to control unit

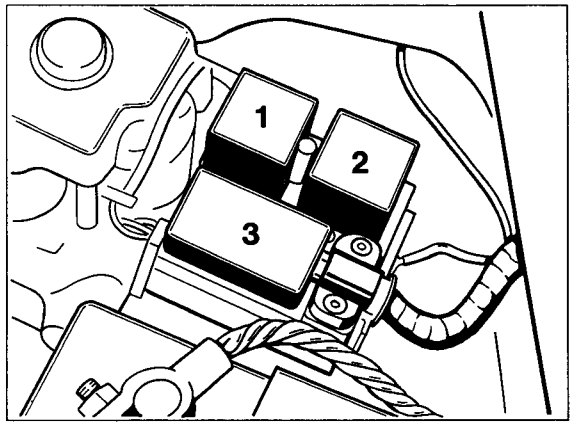
1. Switch off the ignition. Pull the plug off the control unit.
   Check that circuits at plug are not interrupted.

   PIN 21 to PIN 23
   PIN 21 to PIN 17

   If necessary, interrupt the wiring path (plug on locking valve block) and localize the break by reference to the circuit diagram.



2. Pull off valve relay (No. 1) at hydraulic unit.
   Check for a short to positive or earth/ground in the wiring path as described in Item 1, by measuring at PIN 21.
   If there is a fault in the wiring path, separate it as described in Item 1 so that the unwanted connection to the positive or negative side can be localized.



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3. Measure the internal resistance of the lateral locking valve.
   Desired value 2...4 Ω between PIN 1 and PIN 3 on valve block.
   If desired value is incorrect: renew the valve block.

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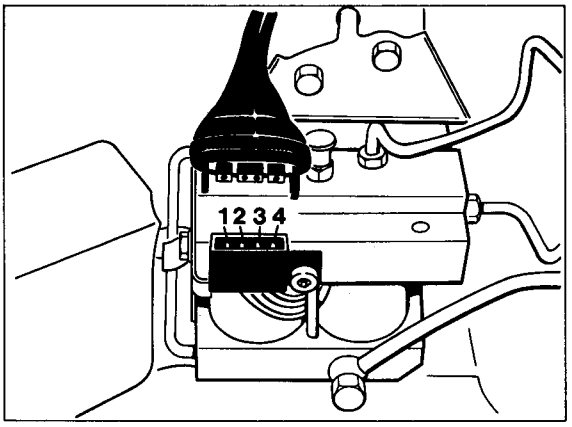
Fault, Fault Code **Possible Causes, Elimination, Remarks**

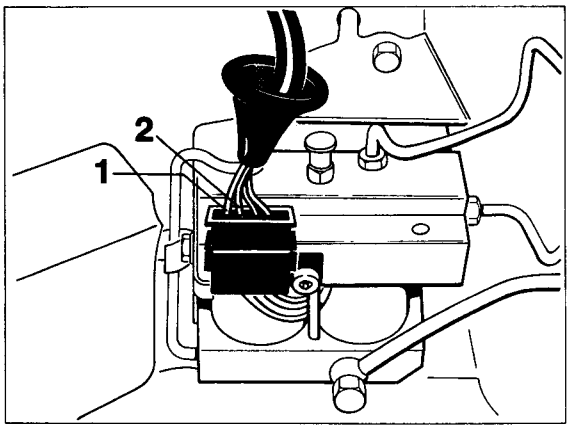


609B-D39/45

4. Check that the valve relay is energized (current present at solenoid valves).
   Attach all plugs and relays. Push back the protective cap at the valve block plug.
   Switch off the ignition, then switch it on again.
   The car's elec. system voltage must be present at PIN 1 and PIN 2.

   If **no** voltage is present: proceed with fault code - 34 - (valve relay). Note testing instructions (see below).

   If a voltage is present, try replacing the PDAS/ABS control unit (output stage defective).



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Notes on testing

If a plug for the power supply to the solenoid valves (ABS or differential lock) is detached while the ignition is switched on, the valve relay is de-energized. Even if the plug is then reconnected, the relay will not be re-energized until the ignition has been switched off and on again.

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Fault, Fault Code	Possible Causes, Elimination, Remarks

2: Lateral acceleration sensor Short-circuit / Break in circuit
Fault code - 12 -

Wiring between control unit and lateral acceleration sensor not in working order (break, short to positive side or to earth/ground), or the lateral acceleration sensor itself is damaged.
The following wiring is installed:

– Power supply to sensor (5 Volt) =
PIN 15 at control unit - PIN 3 at sensor

– Earth/ground for sensor =
PIN 9 at control unit - PIN 1 at sensor

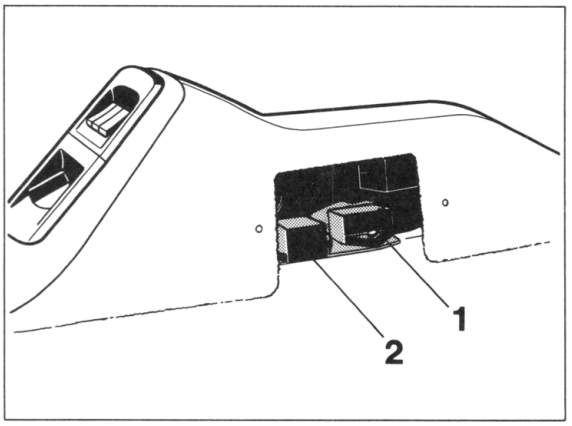
– Signal from sensor to control unit
(2,7 ± 0.14 Volt with car in normal-load position) =
PIN 34 at control unit - PIN 2 at sensor

The PIN data for the sensor plug can be seen on top of the plug after pushing back the protective sleeve.

1. Check power supply (approx. 5 Volt) at the sensor plug (black plug housing) after detaching it, with the ignition switched on.
PIN 1 (-) and PIN 3 (+).

Note

There is a cover on the right side of the center console. The sensors can be reached after removing this cover.
1 = Lateral acceleration sensor
2 = Front-rear acceleration sensor



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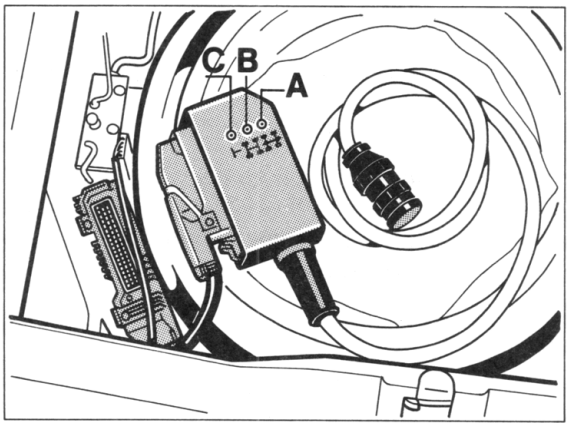
Fault, Fault Code	Possible Causes, Elimination, Remarks

2. Check for break in circuit or short to earth/ground at the wire between PIN 2 at the sensor plug and PIN 34 at the control unit plug after this has been detached.

3. Connect the plug to the sensor. Check the installed position of the sensor and its function by testing the output signal. To make this check, connect the 55-pin ABS 2-LED adapter wire to the control unit plug. Connect the multimeter to sockets B and C.
For meas. procedure and desired values, see Page 45 - 1...45 - 5.



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3: Lateral acceleration sensor Implausible signal
Fault code - 13 -

Signals from lateral acceleration sensor to control unit are incorrect. The sensor has a mechanical defect, its installed position is incorrect or the connecting wires have been accidentally interchanged.

1. Check lateral and front-rear acceleration sensor, Page 45 - 1...45 - 5.

2. Renew the sensor if necessary. No repair work on the sensor is permitted.

3. After eliminating the fault, repeat the test.

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Fault, Fault Code	Possible Causes, Elimination, Remarks

4: Lateral lock Deviation in regulating values
Fault code - 14 -

During the lateral lock regulating phase the monitoring circuit in the PDAS/ABS control unit has identified excessive variations between the desired and actual values.

Possible faults

- Lock control circuit poorly bled (lock actuating hydraulics)
- Lock hydraulics leaking
- Locking valve block (solenoid valve) has a mechanical defect
- Lock cylinder does not retain preset pressure (leaking through load relief bore)
- Inadequate signal from a rear wheel speed sensor
- Fault in lateral lock plates
- Insufficient hydraulic pressure builds up at plates, for example because counter-bearing bolt at engagement lever is wrongly adjusted (only on adjustable version / engagement lever makes contact).

Procedure

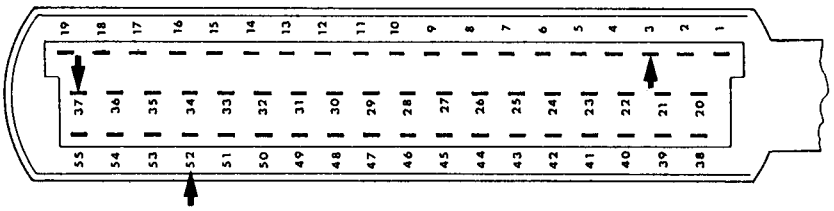
1. Check lock hydraulics for external leaks. Renew defective parts if necessary.
2. Repeat bleeding procedure for lock control circuit (lock hydraulics). If new parts have been installed, the lock must be bled as appropriate. Refer to repair manual, Group 47.
3. Check speed sensor signals (Page D39/45 - 20... 20b).
4. Measure thickness of plates with lock measuring cylinder (special tool 9514). Page D39/45 - 21.
5. Check pressure at locking moment (friction value in lock) (Page D39/45 - 25).

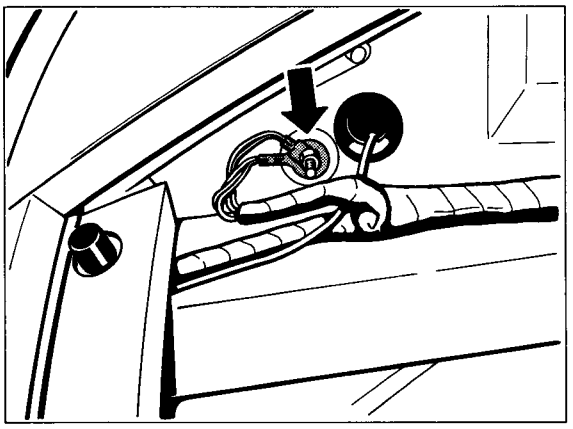
Fault, Fault Code	Possible Causes, Elimination, Remarks

5: Control unit defective
Fault code - 15 -

Before renewing the control unit, check whether:

- there is any electrical interference from the ignition (for example if the spark plug caps are not correctly attached)
- there are any differences in potential caused by contact resistances (missing or poor earth/ground connections).
  Important:
  A poor earth/ground connection may occur not only at the affected components but also at other important earthing/grounding points, for example transmission earth/ground connections (from the starter motor to the body and from the intermediate transmission housing to the earth/ground point on the combined plug connection at the rear right).
- earth/ground contact is present at control unit plug PIN 3, 52 and 37. These wires are connected to earth./ground. point II (in right of trunk).





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Warning

When renewing the PDAS/ABS control unit, make sure that the PSD/ABS control unit for the 928 is not accidentally installed.
For distinguishing features, see Page D39/45-20.

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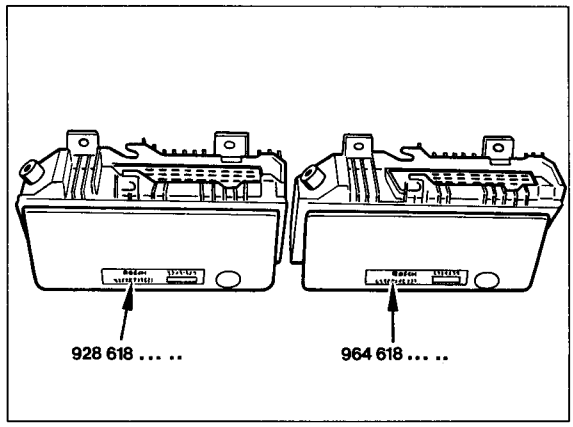
Fault, Fault Code	Possible Causes, Elimination, Remarks

6: Front left speed sensor
Fault code - 21 -

No signal from speed sensor reaches control unit, or signal is incorrect / unrealistic.

Warning: this fault is also indicated if the ABS/PSD control unit for the 928 is installed.
If assembly work has already taken place, check that the correct control unit has been installed.
Distinguishing feature: part number.

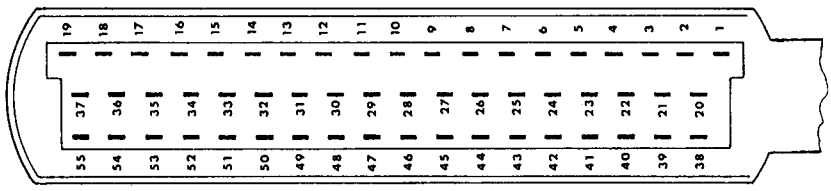
928 control unit with PSD = 928 618 ... ..
911 Carrera 4 control unit = 964 618 ... ..



610 - D39/45

1. Pull of the control unit plug. Measure the internal resistance / check continuity between PIN 51 und PIN 48 on plug.
   Desired value 600...1600 Ω.
   If the desired value is not attained, check the wires and plug connections in the circuit from the front left speed sensor.
   Plug connections: 1 x on left spring strut, 1 x on left spring strut mount in trunk (for distinguishing feature, see Page D39/45 - 13).

   If the desired value (600...1600 Ω) is not reached although the wires / plug connections are in working order, renew the speed sensor.



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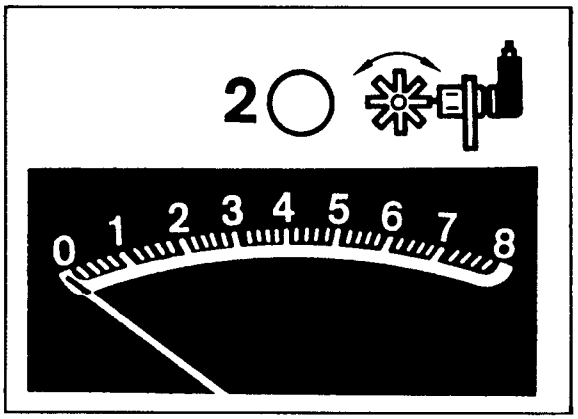
Fault, Fault Code	Possible Causes, Elimination, Remarks

2. Checking the speed sensor signal.
For this check, use ABS 2 - LED tester (Page 45-7), or an oscilloscope.
Connect the ABS 2 - LED tester to the control unit plug with the 55-pin adapter line.

If an oscilloscope is used, separate the speed sensor plug connection at the spring strut or spring strut mount in the trunk (for distinguishing feature, see Page D39/45 - 13).
Connect the oscilloscope to the plug at the speed sensor side.
Depending on the tester, select special input or secondary image.

Check by turning the left front wheel by hand. ABS tester in program switch position 6 / rotary switch for wheel selection to front left wheel. Turn the wheel until the LED (No. 2) lights up without flashing.
If an oscilloscope is used, approx. 1 revolution per second.



D39/45-20a

Desired values / desired value display
ABS 2 - LED tester = > 2.0
Oscilloscope = sine wave > 2 Volt
(measured value: peak to peak)

Possible causes of deviations

Air gap at speed sensor is too large / too small
(check installation).
Pulse wheel is damaged or corroded.
Damage to wheel bearing (wheel bearings are not adjustable).

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Fault, Fault Code	Possible Causes, Elimination, Remarks
7: Front right speed sensor Fault code - 22 -	General procedure as for fault code - 21 - 1. Internal resistance / continuity between PIN 47 and PIN 46 at control unit plug. Plug connections*: on right spring strut and on spring strut mount at right of trunk. 2. Speed sensor signal: if the ABS tester is used, turn the wheel selector switch to the front right wheel.
8: Rear right speed sensor Fault code - 23 -	General procedure as for fault code - 21 - 1. Internal resistance / continuity between PIN 42 and PIN 43 at control unit plug. Plug connections*: 1 x on right rear axle trailing arm and 1 x above the right rear axle stabilizer bearing. 2. Speed sensor signal: if the ABS tester is used, turn the wheel selector switch to the rear right wheel.
9: Rear left speed sensor Fault code - 24 -	General procedure as for fault code - 21 - 1. Internal resistance / continuity between PIN 44 and PIN 45 at control unit plug. Plug connections*: 1 x on left rear axle trailing arm and 1 x at rear left, close to clutch and brake hose on transmission. 2. Speed sensor signal: if the ABS tester is used, turn the wheel selector switch to the rear left wheel.

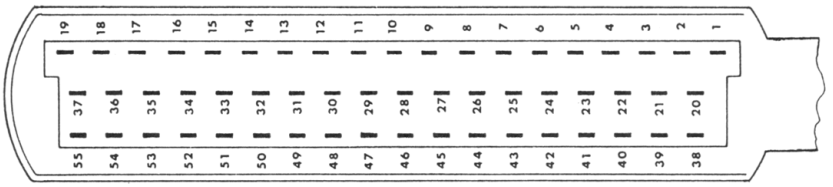
* For distinguishing feature between speed sensor wire and brake pad wear sensor wire, see Page D39/45 - 13.

Fault, Fault Code	Possible Causes, Elimination, Remarks

10: Front left ABS valve
Fault code - 31 -

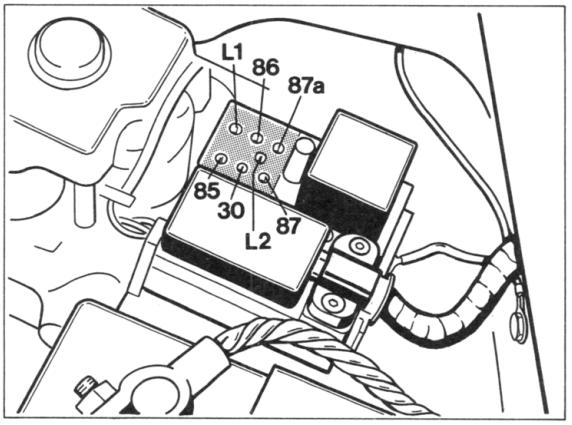
Certain faults in the ABS valve area (short to positive side or to earth/ground) in a control wire) can also be shown as a **valve relay fault** by the 9288 system tester.
A fault in the ABS valve circuits is normally memorized as an **ABS valve fault** in the control unit fault memory.
When the fault memory is read out, it is possible in the above situation for **2 faults to be displayed (ABS valve and valve relay).**

1. Switch off the ignition and pull the plug off the control unit. Check PIN 19 of plug against PIN 17 and against PIN 23 for continuity.
   If necessary, interrupt the circuit (plug at hydraulic unit) and localize the break by reference to the circuit diagram.



2. Pull off the valve relay (7 pole) at the hydraulic unit.
   Check for a short to the positive side or to earth/ground in the circuit as described in Item 1, by measuring at PIN 19.
   If a fault is detected, interrupt the circuit as described in Item 1, in order to localize the incorrect short-circuit to the positive side or to earth/ground.

3. Check resistance between PIN 19 of the plug and terminal 30 at the valve relay base.
   Desired value approx. 1...2 Ω.



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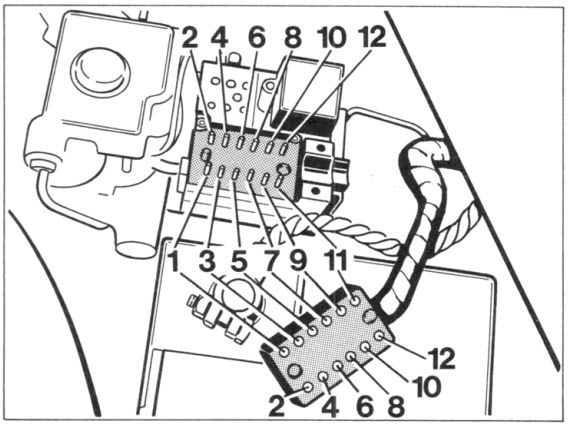
Fault, Fault Code	Possible Causes, Elimination, Remarks

If desired value is obtained: proceed with item 4.

If desired value is not obtained:
Pull off the 12-pole plug at the hydraulic unit (a Torx wrench is needed to relieve tension).
Check internal resistance of ABS solenoid valve. Measure between PIN 1 and PIN 4 (at the hydraulic unit).
Desired value 0.7...1.7 Ω.
If desired value is incorrect: renew the hydraulic unit.



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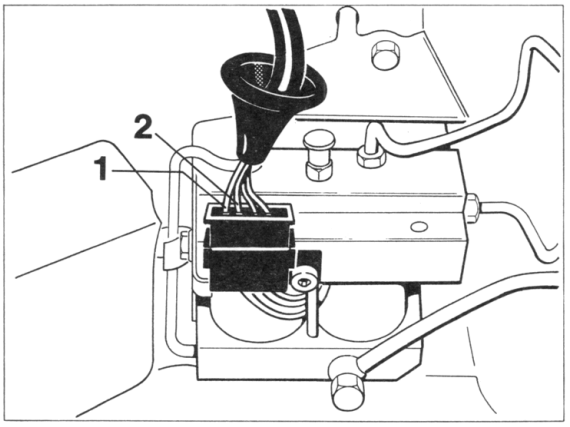
4. Check whether the valve relay is energized (electric current present at solenoid valves).
To make this check, connect all plugs and the relay. Push back the protective cap on the locking valve block plug.
Switch the ignition off, then on again.
The voltage from the car's electrical system must be present at PIN 1 and PIN 2.
If no power supply is present: continue with fault code - 34 - (valve relay). Comply with testing notes.
If the power supply is present, renew the PDAS/ABS control unit experimentally (output stage defective).



Fault, Fault Code	Possible Causes, Elimination, Remarks
	Testing notes If a power supply plug to the solenoid valves (ABS or differential lock) is pulled off while the ignition is switched on, the valve relay will be de-energized. It is not re-energized when the plug is reconnected until the ignition has been switched off and on again.
11: Front right ABS valve Fault code - 32 -	Comply with note under 10: Front left ABS valve, and with fault code - 31 -. When troubleshooting, proceed as for fault code - 31 -, but use PIN 22 instead of PIN 19 on the control unit plug. To check the internal resistance of the ABS valve (after pulling off the 12-pin plug at the hydraulic unit), measure between PIN 3 and PIN 4 (instead of PIN 1 and PIN 4).
12: Rear axle ABS valve Fault code - 33 -	Comply with note under 10: Front left ABS valve, and with fault code - 31 -. For troubleshooting, proceed as for fault code - 31 - but use PIN 2 instead of PIN 19 on the control unit plug. To check the internal resistance of the ABS valve (after pulling off the 12-pin plug at the hydraulic unit), measure between PIN 5 and PIN 4 (instead of PIN 1 and PIN 4).

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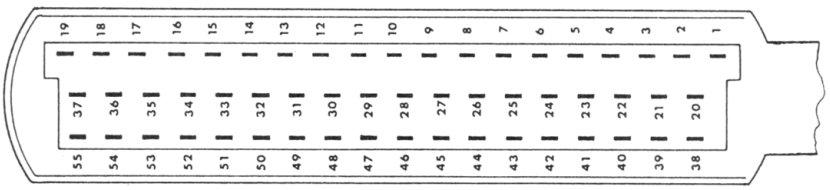
Fault, Fault Code	Possible Causes, Elimination, Remarks

13: Valve relay
Fault code - 34 -

Certain faults in the ABS valve area (short-circuit to positive side or earth/ground in a control wire) may also be shown as **valve relay faults** by the 9288 system tester.
A fault in the ABS valve circuit is normally memorized as an **ABS valve fault** in the control unit's fault memory.
In the case described above, when the fault memory is read out the display of **2 faults is possible (ABS valve and valve relay).**

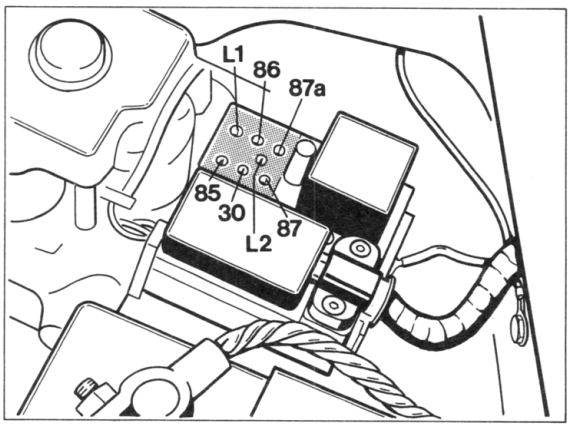
1. Switch off the ignition. Pull off the control unit plug.
   Check the control circuit (wire with relay) - from PIN 20 to PIN 7 - for breaks, short to earth/ground or short to positive side.



If no fault is found, proceed with 2.

If there is a break or a short to the positive side or to earth/ground, pull off the valve relay. Check the wires between terminal 85 on the relay base and PIN 7 on the control unit plug and between terminal 86 and PIN 20.

If the wires are in working order, renew the valve relay.



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Fault, Fault Code	Possible Causes, Elimination, Remarks

2. Measure resistance between the following PINs at the control unit plug:

PIN 19 to PIN 17
PIN 22 to PIN 17
PIN 2 to PIN 17
Desired value approx. 1...2 Ω

PIN 21 to PIN 23
PIN 18 to PIN 23
Desired value approx. 2...4 Ω

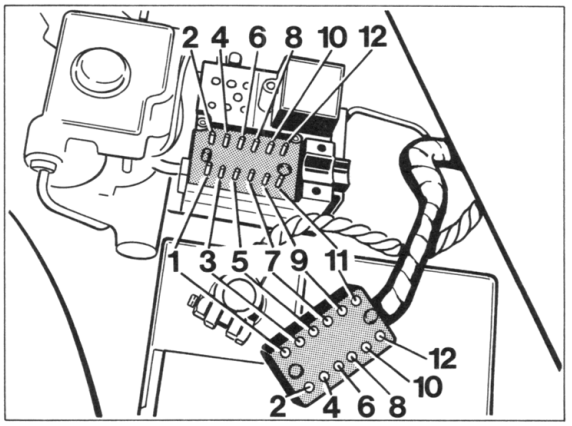
If the desired value is correct, proceed to Item 3.

If incorrect values are obtained, localize the fault as appropriate.
From PIN 19, 22, 2 to PIN 17 = ABS valves + wiring
From PIN 21 and 18 to PIN 23 = Differential locking valves + wiring

Re ABS valves and wiring

Pull off the 12-pole plug at the hydraulic unit.
Measure the internal resistance of the solenoid valves.
PIN 1 against PIN 4
PIN 3 against PIN 4
PIN 5 against PIN 4
Desired value approx. 0.7...1.7 Ω

Desired value not obtained: renew hydraulic unit.



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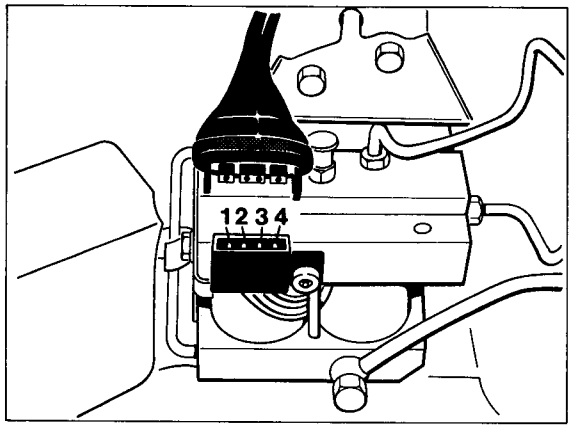
Fault, Fault Code	Possible Causes, Elimination, Remarks

Re: differential locking valves and wiring:

Pull plug off valve block. Measure internal resistance of solenoid valves.
PIN 1 against PIN 3 and PIN 2 against PIN 4
Desired value 2...4 Ω
If an incorrect value is obtained: renew the valve block.



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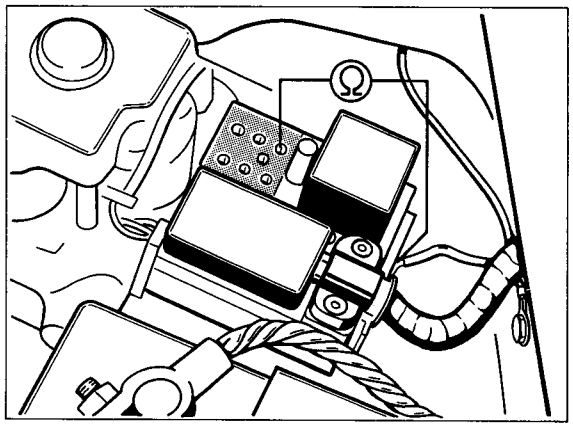
3. Pull off valve relay (7-pole) at hydraulic unit. Measure at control unit plug PIN 17 in order to determine whether there is a short to the positive side or to earth/ground.
   If necessary, interrupt the circuit at the hydraulic unit plug (12-pole) and localize the fault by reference to the circuit diagram.

4. Check that the power supply is present at terminal 87 of the relay base (car's electrical system voltage) when the valve relay is pulled off. Desired reading: approx. 12 Volt (car's on-board system voltage).

5. Measure resistance between terminal 87 a on the relay base and the earth/ground wire at the pump motor.
   Desired value ≈ 2...4 Ω. It is essential for the earth/ground wire and the earth/ground point to be in working order.
   If necessary, renew the hydraulic unit (resistor in relay base has increased in value).



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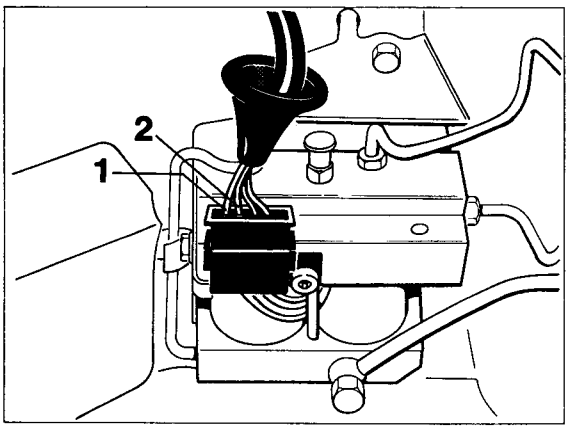
Fault, Fault Code **Possible Causes, Elimination, Remarks**

6. Check the wires from terminal L1 on the relay base to PIN 24 on the control unit plug and from L2 to PIN 35 for a break in circuit.

7. Check that the valve relay is energized (voltage present at solenoid valve).
   Reconnect all plugs and the relay.
   Push back the protective cap on the locking valve plug block.
   Switch the ignition off, then switch it on again.
   The voltage of the car's electrical system must be present at PIN 1 and PIN 2.



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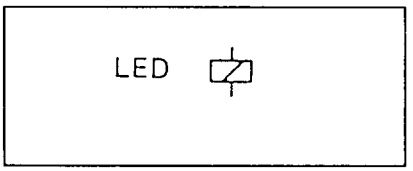
If no voltage is present, renew the valve relay experimentally, or test with the ABS 2-LED tester to make quite sure that the relay is genuinely defective.

If the LED on the ABS tester fails to light up steadily in program switch position 5 with the ignition switched on, the relay is defective.



8. If the valve relay is in working order, renew the PDAS/ABS control unit experimentally (output stage defective).

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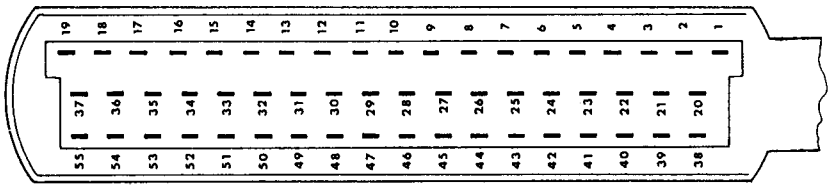
Fault, Fault Code	Possible Causes, Elimination, Remarks

14: Return pump
Fault code - 35 -

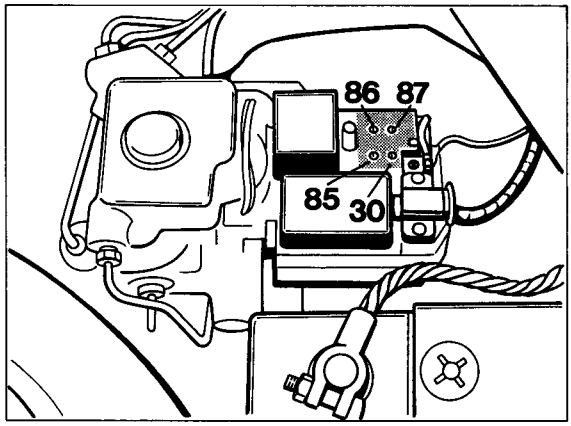
1. Switch off the ignition. Pull off the plug at the control unit. Check control circuit (wire with relay) - PIN 20 to PIN 5 - for break or short-circuit to positive side or to earth/ground.



If no fault is found, proceed with 2.

If a break or short to the positive side or to earth/ground is present, pull off the motor relay. Check the wiring between terminal 85 at the relay base and PIN 5 at the control unit plug, and and between terminal 86 and PIN 20.

If the wiring is in working order: renew the motor relay.



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2. Pull off the motor relay. The car's electrical system voltage (app. 12 Volt) must be present at terminal 87 of the relay base.

3. Bridge terminals 30 and 87 at the relay base.
If the return pump does not run, continue at 4.

If the return pump runs:

Check the wire from terminal 30 on the relay to PIN 31 at the control unit plug. If the wire is in working order: renew the motor relay.

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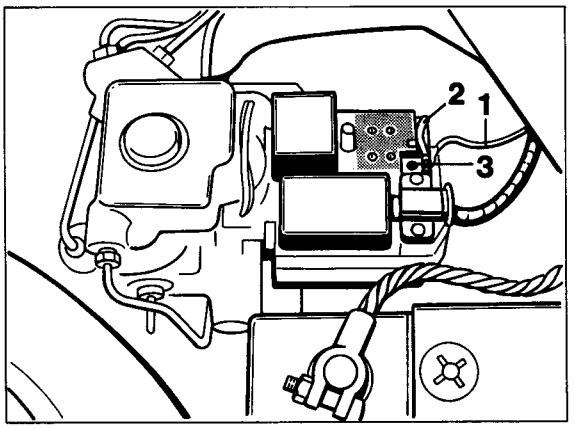
Fault, Fault Code	Possible Causes, Elimination, Remarks

4. Check connections at earth/ground wire (1) and positive wire (2) for contact resistance.
Bridge terminals 30 and 87 at the relay base and check that the electric current is reaching connecting point (3).
If the current is present at this point (but the return pump is not running): renew hydraulic unit (defective return pump).



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15: Front-rear differential lock valve
Fault code - 41 -

Proceed in general as for fault code - 11 -

1. Check control unit plug for continuity.

   PIN 18 against PIN 23
   PIN 18 against PIN 17

2. Pull of the valve relay at the hydraulic unit.
   Check whether there is a short to the positive side or to earth/ground in the circuit as descr. in Item 1. For this check, measure at PIN 18.

3. Measure internal resistance of front-rear locking valve.
   Desired value is 2...4 Ω between PIN 2 and PIN 4 at the valve block.
   If desired value is not obtained: renew the valve block.

4. As Item 4, fault code - 11 -.

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Fault, Fault Code	Possible Causes, Elimination, Remarks
16: Front-rear acceleration sensor Short circuit / line break Fault code - 42 -	General procedure as for fault code - 12 - Note different PINs in use at control unit and different plug housing color at longitudinal acceleration sensor. **Output signal fron longitudinal acceleration sensor:** PIN 2 at sensor plug (grey plug housing) and PIN 13 on control unit / control unit plug. **Power supply and earth/ground:** Pins occupied at control unit and sensor plug are the same as for the lateral acceleration sensor.
17: Longitudinal acceleration sensor Implausible signal Fault code - 43 -	Signals from longitudinal acceleration sensor to control unit are incorrect. Sensor has a mechanical fault, installed position is incorrect or connecting wires have been accidentally interchanged. 1. Check lateral and longitudinal acceleration sensor, Page 45 - 1...45 - 5. 2. Renew sensor if necessary. Repairs to the sensor are not permitted. 3. After eliminating the fault, repeat the check.
18: Front-rear differential lock control deviations Fault code - 44 -	During the front-rear control process the monitoring circuit in the PDAS/ABS control unit has detected excessive discrepancies between the desired and actual values. If a speed sensor fault has also been memorized, the fault is probably restricted to the speed sensor signal. **Possible faults** Proceed in general as for fault code - 14 - with the foll. difference: - front or rear wheel speed sensor is not supplying an adequate signal - front-rear differential lock plates not in working order. **Procedure** - in general as for fault code - 14 -

Fault, Fault Code	Possible Causes, Elimination, Remarks
19: Full differential locking button Fault code - 45 -	The fault is also recorded if the full locking button (the traction switch on the center console) is held in the "Engage locks" for longer than 10 seconds.

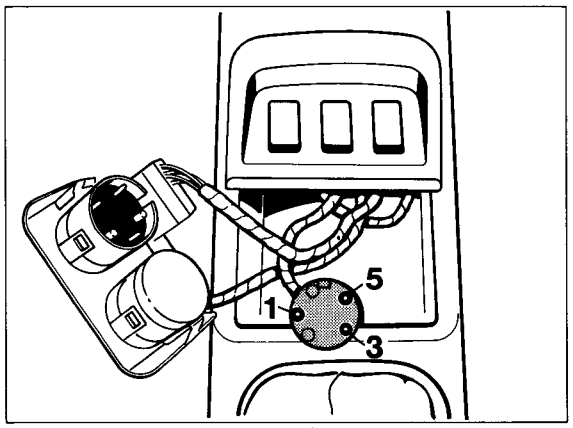
1. Check whether an operating error or a genuine fault has occurred.
   For this check, enter Menu 3 = Switch inputs with the System Tester.

   Desired System Tester display with:

Switch in central position	: OPEN
Switch turned to right and held	: ON
Switch turned to left and held	: OFF

2. If a genuine fault has occurred, pull the plug off the full locking switch.
   Checking the full locking switch:
   Correct continuity between PIN 1 and PIN 3 when switch is turned to right and held.
   Correct continuity between PIN 1 and PIN 5 when switch is turned to left and held.

3. **Checking wiring / earth/ground and positive potential:**
   The current must be positive at PIN 3 of the switch plug when the ignition is switched on (≈ battery voltage / control unit plug attached).
   Earth/ground must be present at PIN 5 of the switch plug.
   Check that there is no break in the wire between control unit plug PIN 28 and PIN 1 of the switch plug.
   Make sure that this wire has no short to earth/ground or to the positive side.



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Printed in Germany – X, 1990

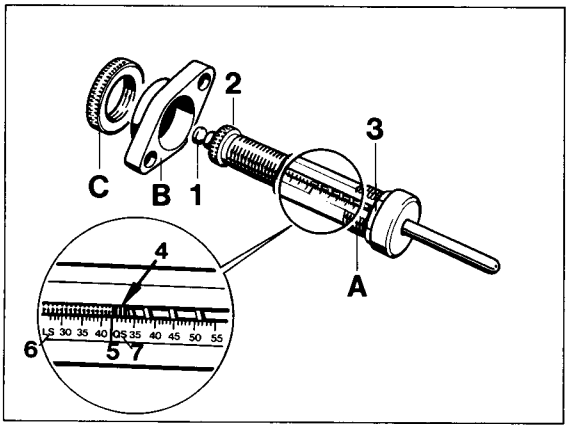
Measuring the disk wear on the longitudinal and transverse locks

Note

The wear dimension can be determined only with the lock measuring cylinder - special tool 9514.

Explanation of special tool 9514

The scope of delivery of special tool 9514 comprises the parts A-B-C. The assembly consisting of A-B-C is used for transverse lock measurement. Only Part A is needed for longitudinal lock measurement.



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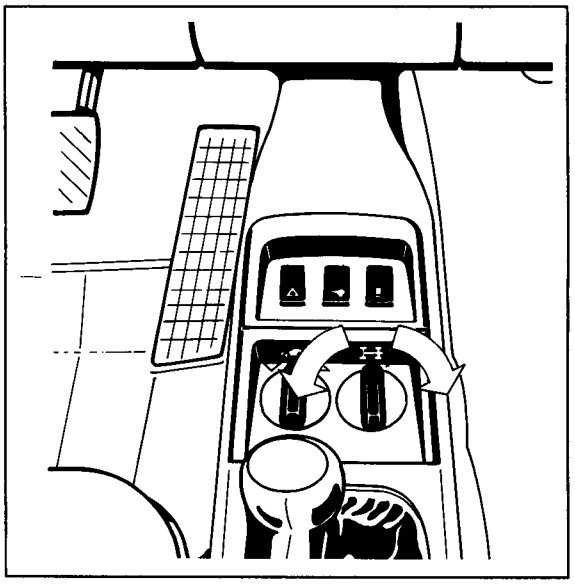
A Measuring cylinder
B Flange for transverse lock testing
C Flange securing nut
1 Spacer tappet
2 Adjusting screw
3 Two surfaces for fixing the measuring cylinder for longitudinal lock measurement
4 Measuring groove on adjusting screw
5 Separating line for LS and QS measuring ranges
6 LS = Longitudinal lock measuring range
7 QS = Transverse lock measuring range (also for PSD of 928)

Preliminary work

1. To prevent the measured result from being corrupted, close the locks 2 x at full booster pressure before measurement.

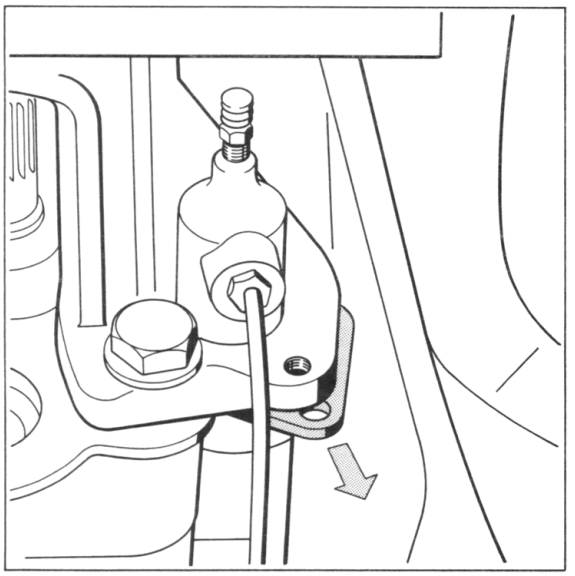
   To do this:
   - Switch on the ignition
   - Press the brake pedal as often as required until the pump assembly starts running.
   - When the pump assembly has switched off independently, turn the full-lock switch (traction switch in the center console) to the right (close lock). Then turn the switch to the left (open lock).
   - Repeat this operation, i.e. close and open the locks once more.
   - Switch off the ignition.



D39/45-21

2. Depressurize the booster circuit for safety reasons. To do this, remove the ignition key and then operate the brake pedal approx. 25 times.

3. Remove the slave cylinders.
- Transverse lock: Undo the fixing screws on the slave cylinder. Do not undo the pressure line.
- Longitudinal lock: Unscrew the screw on the slave cylinder and pull out holding plate (arrow). Do not undo the pressure line.
- Unclip the pressure line at the transmission and hang both lock cylinders to the side with connected line.

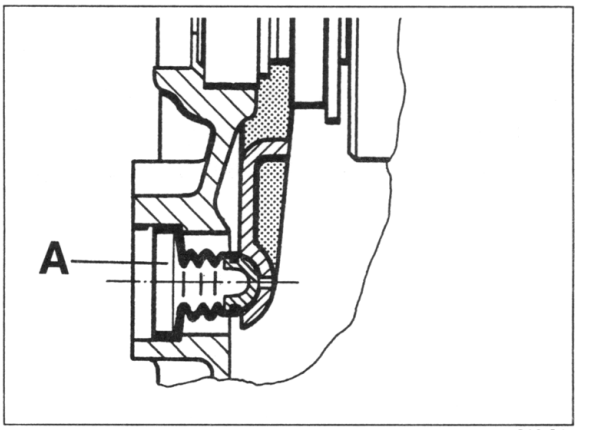


148-10

Measurement

Note

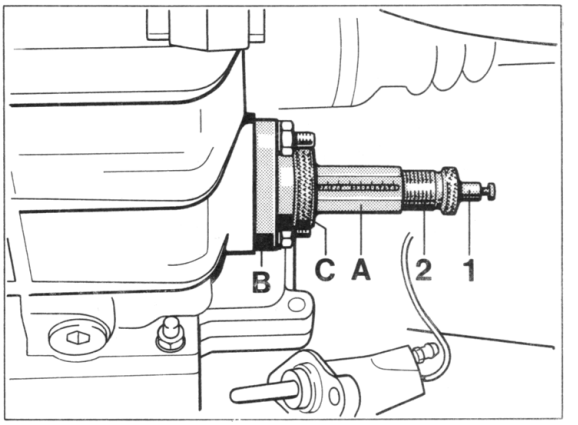
Perform measurement only after completion of all preliminary work. The sealing bellows (A) in the transmission case remains installed for measurement on the longitudinal and transverse locks.



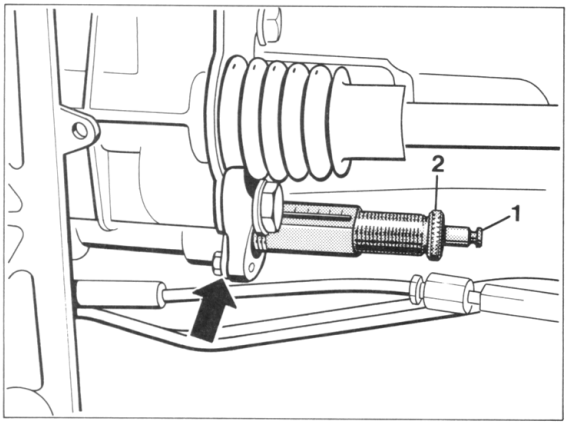
210-34

1. Back off the adjusting screw of the measuring cylinder (2) as far as possible so that assembly of the measuring cylinder is made easier.

2a. Measure transverse lock.
Fit the measuring cylinder (A) with flange (B) on the transmission. Align the measuring cylinder so that the measurement scale is easily visible. Tighten the flange securing nut (C).



2b. Measure the longitudinal lock.
Secure the measuring cylinder with holding plate for the slave cylinder (arrow) on the transmission.



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3. Screw in the adjusting screw (2) on the measuring cylinder until there is no axial play at the spacer tappet (1) or so that there is just minimally perceptible axial play. Read off the axial dimension on the measuring cylinder in this position.
If the wear dimension has been reached, the disks of the lock must be replaced.

Note

If the first bearing screw of the engaging lever is adjustable, do not correct (manipulate) the wear dimension at the screw under any circumstances. In contrast, the adjustment dimension must be produced with the adjustable thrust bearing screw when new disks are installed.

Adjustment and wear dimension in mm

	Not adjustable	adjust.
Transverse lock:		
Adjustment dimension/ new dimension	approx. 33	31
Wear dimension		
Gylon discs*	36	36
Valeo discs**	40	40
Longitudinal lock:		
Adjustment dimension/ new dimension	approx. 29.5	29.5
Wear dimension	32.5	32.5

4. If the disks are ok, assemble the slave cylinders on the transmission again.

Note

If the sealing bellows (A-drawing 210-34) leaks, always replace the corresponding slave cylinders as well. In this case, bleed the lock cylinders and pressure line with system tester 9288 afterwards (P. 47-5).

5. Check general operation of the lock (brief test drive).

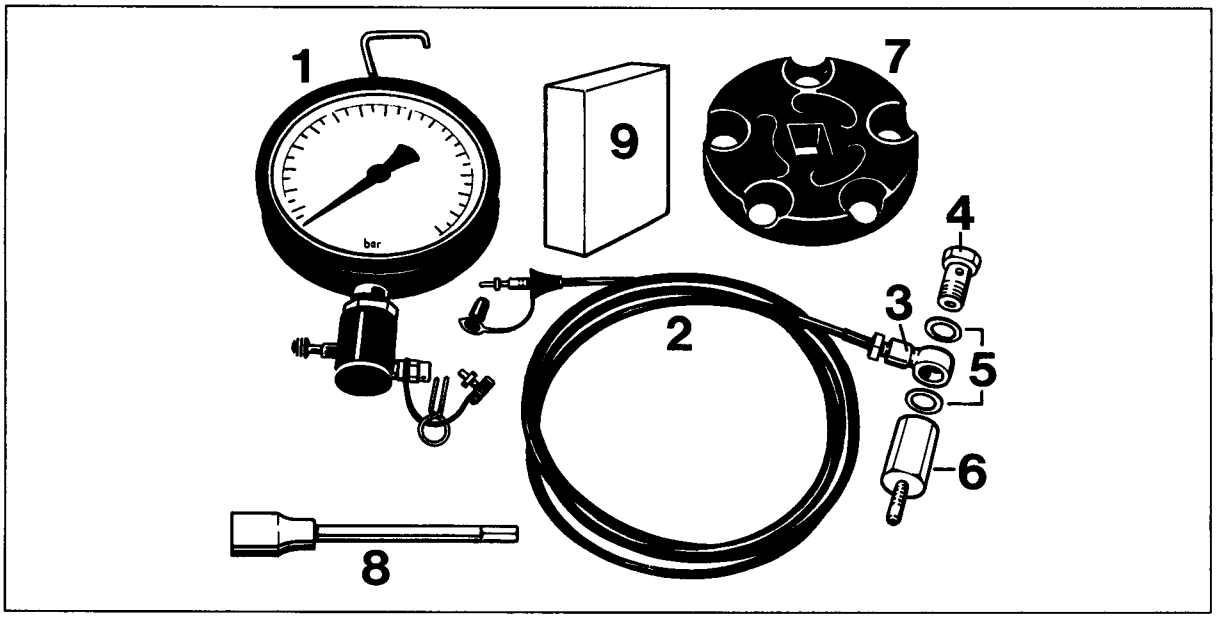
* **Initial version (Gylon discs)**. Before testing, check **if Valeo discs are fitted. Identification: "V"** embossed on transmission housing flange bottom that the look cylinder is fitted to (observe Technical Information).

** **Modified/present version (Valeo discs)**
Introduced for production as of **01-01-91, as of transmission No.** G 64 00 01146 / G 64 01 30 00529 / G 64 02 30 00501.

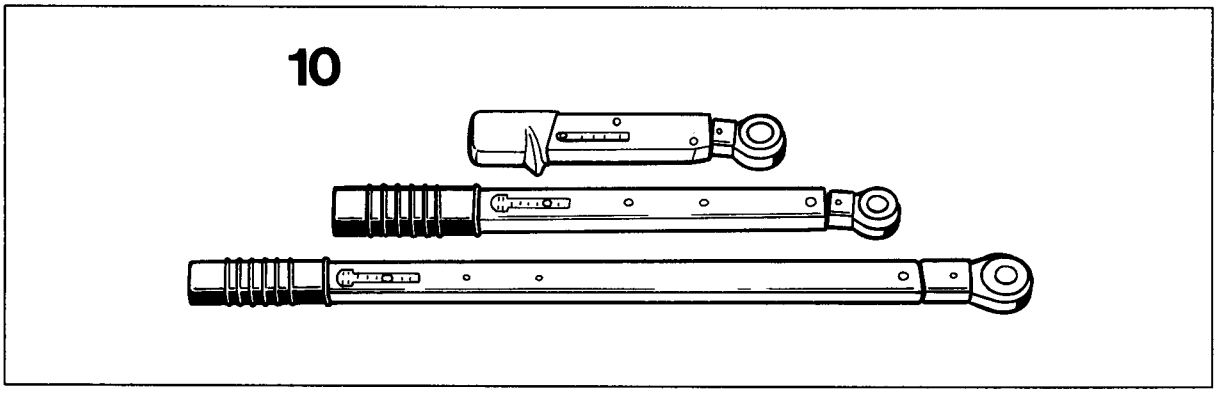
Printed in Germany - XVIII, 1992

Checking locking moment (friction coefficient) of longitudinal and transverse locks

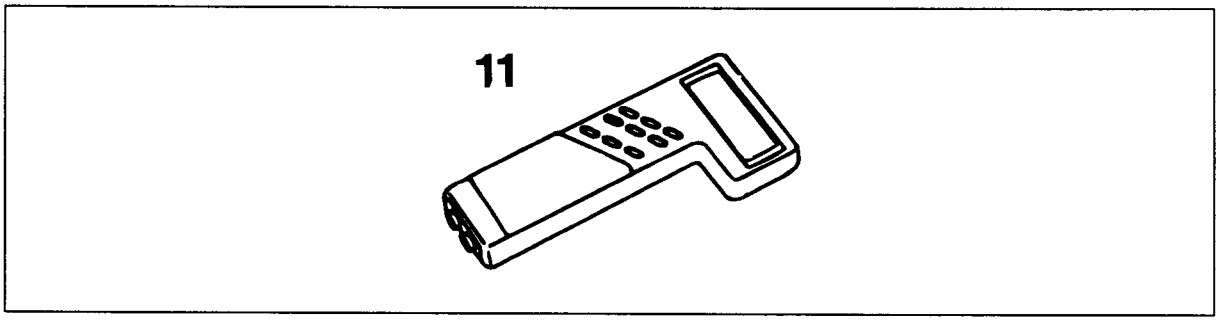
Tools



345-D39/45



483-D39/45



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Tools

No.	Designation	Special tool	Order number	Explanation
1	Manometer	9509	000.721.950.90	Also used for checking pressure of booster circuit (P.47-9)
2	High-pressure measuring line	9509/1	000.721.950.91	
3	Inlet union	-	999.215.027.02	
4	Inlet-union screw	-	999.134.035.00	Shorten thread by approx. 4 mm
5	Seal ring	-	N 013 811 2	2 pcs.
6	Connector	9509/3	000.721.950.93	
7	Torque adapter plate	9510	000.721.951.00	
8	Hexagon socket wrench	P 119	000.721.119.00	Used for removing / installing brake calipers. A conventional 10 mm hexagon socket wrench may also be used
9	Retaining block	9509/4	000.721.950.94	2 pcs. Only 1 is necessary for checking transverse lock; 2 are required for checking longitudinal lock.
10	Torque-setting torque wrench covering the range from 5 - 500 Nm (3.7 - 367 ftlb)			Conventional (see Workshop Manual). Depending on torque wrench version, corresponding reduction or union pieces are required for attachment to the adapter plate (No. 7).

No.	Designation	Special tool	Order number	Explanation
11	System Tester 9288	9288	000.721.928.80	
	with			
	connecting cable	9288/1	000.721.928.81	
	and			
	corresponding	9288/4	000.721.928.84	German
	program module	9288/5	000.721.928.85	English
	(depending on language)	9288/6	000.721.928.86	French
		9288/7	000.721.928.87	Italian
		9288/8	000.721.928.88	Spanish

Printed in Germany – VII, 1990

Checking locking moment (friction coefficient) of longitudinal and transverse locks

Important information

Perform check with gearbox cold. Parking brake released, no gear engaged.
Check transverse lock first.

When checking locking moment it is not initial wheel spin moment but breakaway moment (when lock no longer holds) which is measured. A torque-setting torque wrench is therefore required.

Checking

Procedure	Instructions
1. Carry out general preparatory work as described on right	– Remove rear wheels – Using original wheel nuts **attach** torque adapter plate (Special Tool 9510) **to rear left-hand wheel hub** – Remove underfloor paneling and component protection elements – Have torque-setting torque wrenches covering approx. 5 - 500 Nm (3.7 - 370 ftlb) in readiness. Appropriate reduction or adapter pieces are necessary for connecting these to adapter plate.

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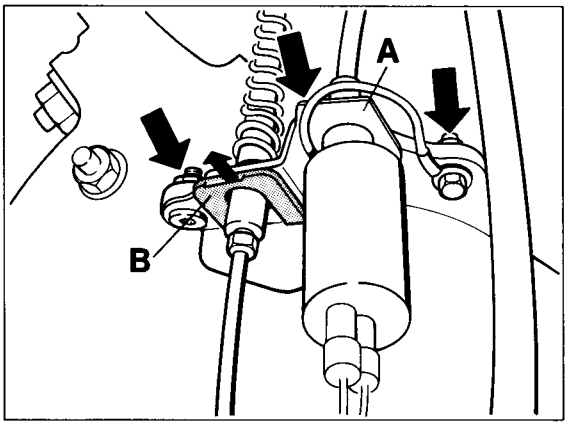
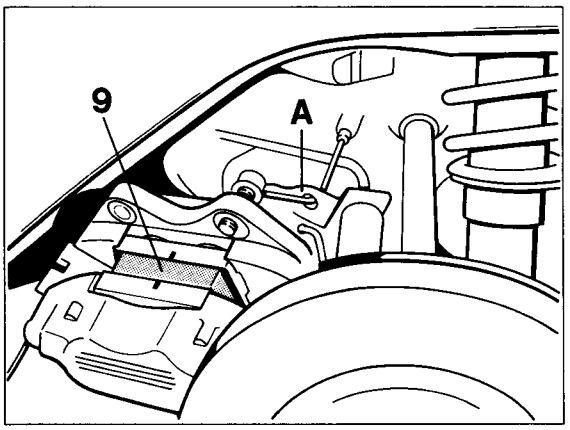
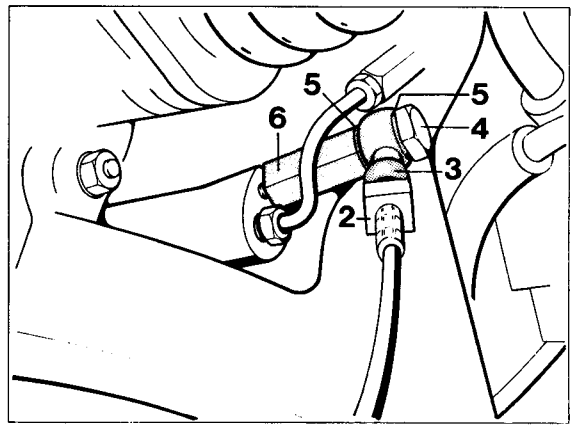
Procedure	Instructions
2. Prepare vehicle for testing transverse locks To do so: – Remove rear left-hand brake caliper (do not open brake hydraulics) and insert retaining block - Special Tool 9509/5 - into brake caliper instead of brake disc. – Connect manometer to transverse lock cylinder, first removing ignition key for safety reasons. – Plug System Tester 9288 into diagnosis socket. – Bleed manometer.	– Disconnect ground cable and retainer (A) from left-hand rear axle link (arrows), first extending brake hose retainer (B). This means brake line or brake hose does not have to be opened when brakecaliper is removed.  476-D39/45 – Remove rear left-hand brake caliper using suitable conventional hexagon socket wrench or Special Tool P 119. Insert retaining block (No. 9) into brake caliper instead of brake disc. Place brake caliper on rear axle link or other convenient place.  477-D39/45

Procedure	Instructions

– Connect inlet union (No. 3) to measuring line (No. 2). Then **fit** this assembly, in conjunction with inlet-union screw, seal rings and connector (No. 4/No. 5/No. 6) **instead of bleed valve to transverse lock servo cylinder.**

Important information

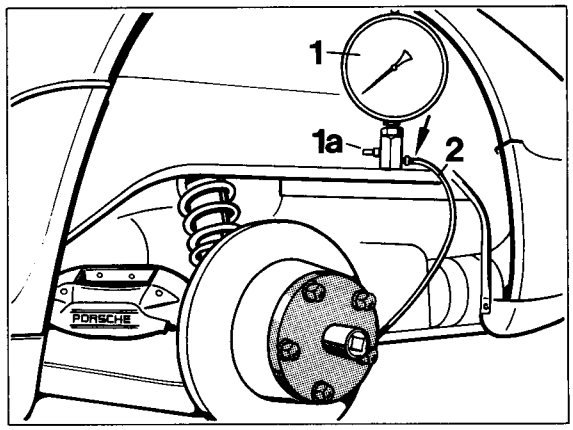
Tighten No. 4 and No. 6 carefully, or apply counter-pressure when tightening them to avoid misalignment. Failure to observe this precaution could cause connector (No. 6) to break off. Before opening bleed valve, ensure lock cylinder is not under pressure (e.g. due to full-lock button). It is therefore best to remove ignition key.



478-D39/45

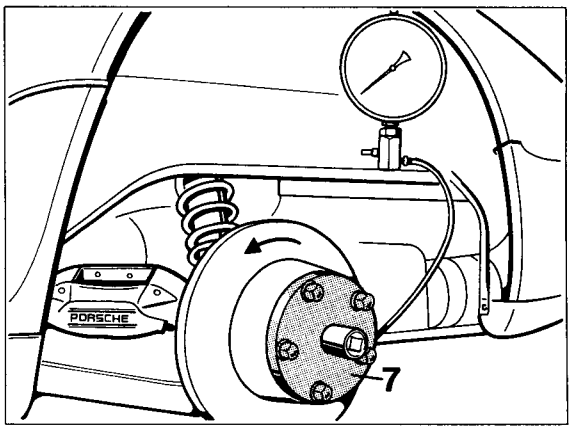
Procedure	Instructions

– Connect high-pressure measuring line (No. 2) to manometer (arrow) and attach manometer in rear left-hand area of wheel house where it is clearly visible.
Connect System Tester 9288 (P. D39/45-9).
Bleed manometer. To do so, activate locking solenoid valves with System Tester in menue for drive links / bleeding and drain brake fluid from bleed valve until no more air bubbles appear.
(Drain fluid into receptacle).
Close bleed valve and press stop button. Move to position for pressure reduction.



480A-D39/45

Procedure	Instructions
3. Measuring transverse lock moment (locking moment to pressure)	
Checking conditions / important information – Gearbox cold / handbrake released, no gear engaged – Before measuring, briefly close lock once (applying full pressure) – To measure locking moment, only turn towards the front. Measuring should be performed via the adapter plate on rear left-hand wheel hub – Completely lock both front wheels and rear right-hand wheel by means of footbrake – Use torque wrench to measure breakaway moment / locking moment at prescribed testing pressures. **Do not turn jerkily. Work up gradually from lower value to breakaway moment / locking moment.** – Produce test pressures with System Tester 9288 by activating transverse lock solenoid valve (menue drive links / check transverse lock).	– Switch on System Tester. Select "check transverse lock" – Completely close transverse lock by means of approx. 20 impulses (pressure at manometer approx. ≈140...180 bar). Pressing function button on Tester = 1 Impulse – Move to position for pressure reduction and start with measurement 1 – **Measurement 1 = manometer pressure 0...5 bar** Set torque wrench to approx. 5 Nm (3.7 ftlb) and connect to adapter plate on rear left-hand wheel hub (No. 7). Observe ratchet direction of torque wrench. During measurement operate footbrake so that remaining three wheels are completely locked. Using torque wrench carefully (i.e. not jerkily) turn **forwards.** If wheel hub does not turn but torque wrench starts clicking, actual locking moment has not been reached. Set torque wrench to higher value and repeat procedure. Actual locking moment is reached when wheel hub turns just as torque wrench begins to click. If wheel hub turns but wrench does not click, torque setting on wrench is too high (actual value is lower).
Test pressures / measuring items Measurement 1 = press. from 0...5 bar Measurement 2 = " " 20...40 bar Measurement 3 = " " 40...60 bar Measurement 4 = breakaway moment min. 500 Nm (367 ftlb), pressure 80 bar or greater Measurement 5 = Check transverse lock admission valve. Prescribed value approx. 2.0...3.5 bar – Observe checking conditions on left	

Procedure	Instructions
Time limit values (permissible locking values) and corresponding pressures are shown on P. D39/45-38. **Possible causes of deviation from prescribed figure** – Checking conditions not met. E.g. wheels not completely locked, manometer or locking hydraulics not properly bled – Clutch plates not in good condition – Hydraulic pressure not acting on clutch plates at level indicated, e.g. due to incorrectly adjusted end support screw of engaging lever (only with adjustable lever/engaging lever is in contact).	For checking breakaway moment, measure at several points (angles) within one turn of the wheel. Once locking moment has been reached, immediately read off pressure on manometer. Note both actual values (moment + pressure).  480B-D39/45 – **Measurement 2 = manometer pressure 20...40 bar** Produce test pressure with System Tester with suitable number of impulses. Set torque wrench to minimum value (depending on pressure) in accordance with limit table (P. D39/45-38). Repeat procedure as for measurement 1. – **Measurement 3 = manometer pressure 40...60 bar.** Repeat procedure as for measurements 1 and 2. – Compare actual values of measurements 1/2/3 with those prescribed on P. D39/45-38.

Procedure	Instructions
	Example: **Measurement 2 = manometer pressure 20...40 bar** Actual values: manometer pressure 31 bar measured locking torque 260 Nm (190.6 ftlb) Prescribed value acc. to table 31 bar 200...290 Nm (146.6...212.6 ftlb) Measurement 2 in order, as it is within tolerance margins (limit table) – **Measurement 4 = min. locking moment 500 Nm (367 ftlb) must be ensured. Pressure 80 bar or more.** – **Measurement 5 = admission valves** Move to position for pressure reduction and read off manometer pressure. Prescribed value: approx. 2.0...3.5 bar. If necessary, for values outside tolerance and with low pressure - max. 20 bar - repeat process, reducing pressure by switching off ignition.

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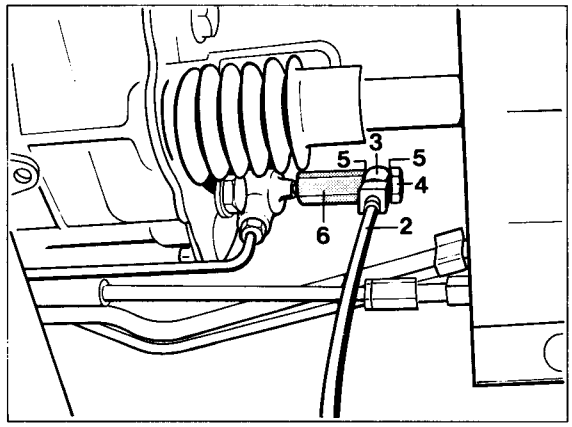
Procedure	Instructions
4. Switch off System Tester remove ignition key (lines from solenoid valve to admission valves therefore not under pressure)	– Switch off System Tester. For following point remove ignition key for safety reasons.
5. Prepare vehicle for longitudinal lock measuring: – Remove manometer measuring line **from transverse lock cylinder** and attach in same way to **longitudinal lock cylinder**.	– Cautiously open measuring line on transverse lock on transverse lock cylinder (admission pressure). Remove measuring line and fit bleed valve.
– Also remove rear right-hand brake caliper (without opening hydraulics) and insert second retaining block - Special Tool 9509/4 - into brake caliper instead of brake disc. If a brake pedal clamp was used for transverse lock measurement, remove this first	– Fit measuring line assembly (No. 3 and No. 2) in conjunction with inlet-union screw (No. 4), seal rings (No. 5) and connector (No. 6) instead of bleed valve on longitudinal lock cylinder. **Important information** Tighten No. 4 and No. 6 carefully, or apply counter-pressure when tightening them. Avoid misalignment, otherwise connector (No. 6) could break off.
– Bleed transverse lock. Bleed manometer.	– Remove rear right-hand brake caliper and insert second retaining block - Special Tool 9509/4 - into brake caliper instead of brake disc. Do not open brake hydraulics. Bleed transverse lock and manometer with System Tester 9288. Since these points are approximately the same as procedure for transverse lock testing, refer to point 2 for details if necessary.



479-D39/45

Procedure	Instructions
6. Perform longitudinal lock check (locking moment to pressure) Same checking conditions as for transverse lock, except that only front wheels are locked.	– Same procedure as for transverse lock testing except for following points:
Test pressures / measuring procedures Measurement 1 = press. from 0...5 bar Measurement 2 = "" 10...30 bar Measurement 3 = "" 30...60 bar Measurement 4 = Breakaway moment min. 500 Nm (367 ftlb), pressure 60 bar or over. Measurement 5 = admission valve of longitudinal lock. Prescribed value approx. 2.0 ..3.5 bar Limit values (permissible locking values) and corresponding pressures are shown on P. D39/45-38.	Only front wheels are locked On System Tester select menue for drive links / checking longitudinal lock Transverse lock is automatically closed by System Tester when menue item for checking longitudinal lock is selected Test pressures for measurements 1...4 are different (see left-hand column) – Completely close longitudinal lock using System Tester – Move to position for pressure reduction and start with measurement 1 as described in point 3. – Compare actual with prescribed values (S. D39/45-38)
Possible causes of deviations from prescribed value Checking conditions not met. E.g. wheels not completely locked, manometer or locking hydraulics not properly bled. Transverse lock values not correct, causing deviations for longitudinal lock Longitudinal lock clutch plates not in good condition Hydraulic pressure not acting on clutch plates at level indicated, e.g. due to incorrectly adjusted end support screw of engaging lever (only with adjustable version / engaging lever is in contact).	

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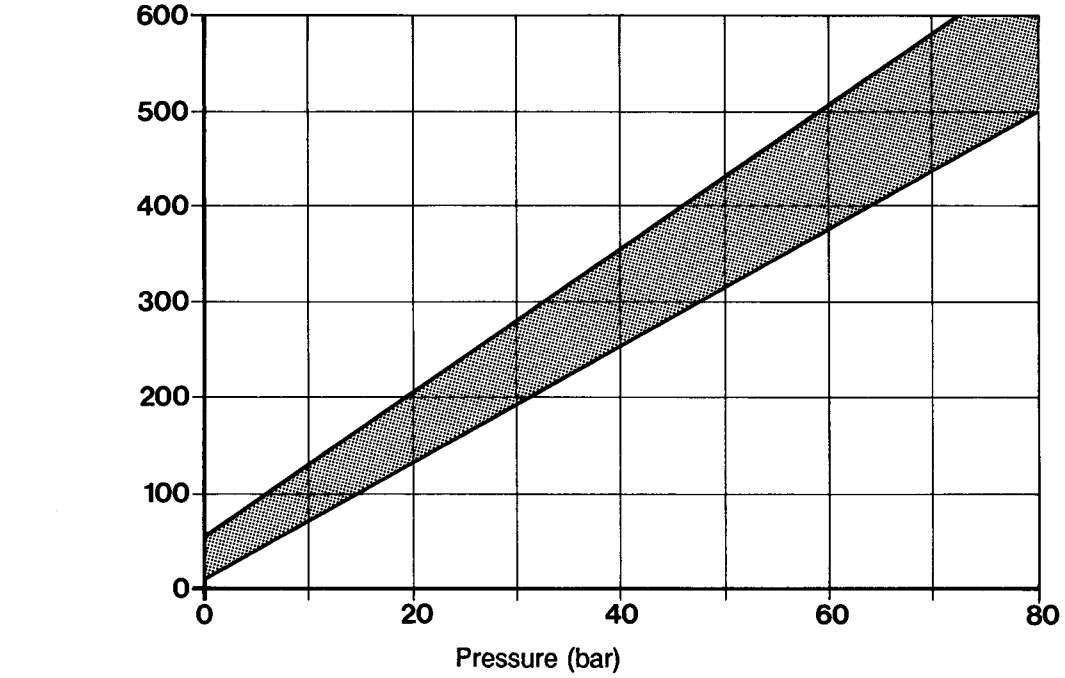
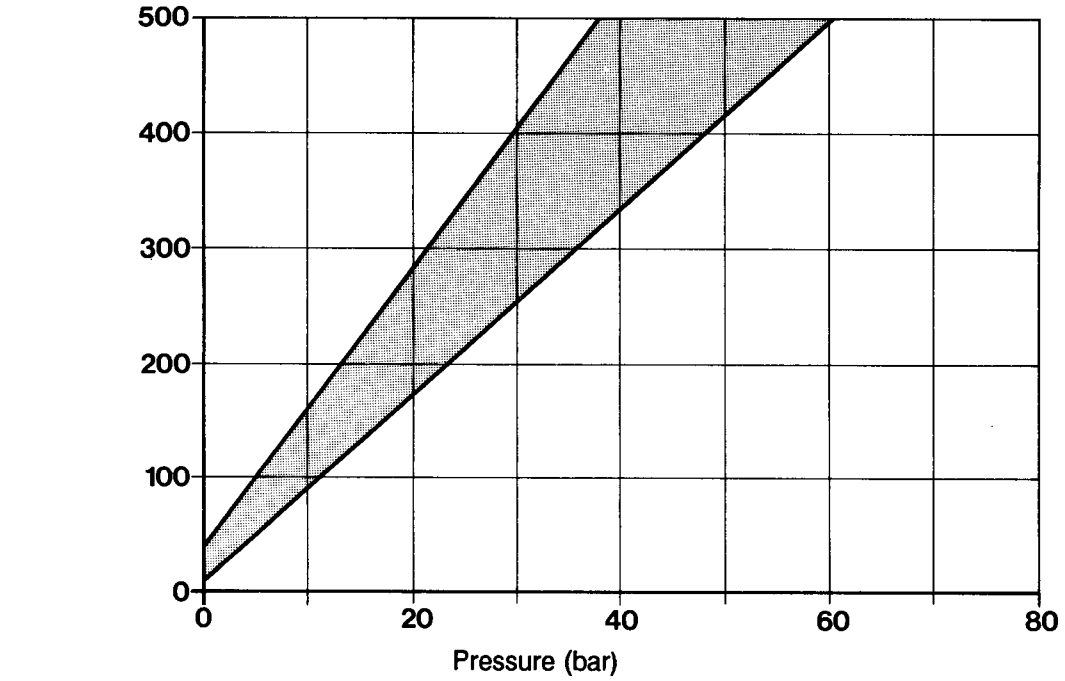
Procedure	Instructions
7. Remove manometer with System Tester switched off and ignition key removed (so only admission pressure in measuring line applies). Fit bleed valve and bleed longitudinal lock.	– Cautiously open measuring line on longitudinal lock cylinder (due to admission pressure). Remove measuring line and fit bleed valve. – Bleed longitudinal lock using System Tester 9288. Switch off System Tester.
8. Fit rear brake calipers and disconnect System Tester. Correct brake fluid level. Check locking hydraulics for leaks.	– Tighten brake cylinder fastening bolts to 85 Nm (62.3 ftlb). Fit bracket on rear axle links and fit brake hose bracket. **Operate brake pedal several times.** – Disconnect System Tester and correct brake fluid level with pressure reservoir completely full (after pump unit has automatically switched off). **On no account top up above "max. " mark.** – Check exterior of hydraulic lines (brake and lock) in area of rear axle for leaks. To activate full system pressure in lock servo cylinders, turn full lock button on center console to the right **with ignition switched on**. To disengage lock turn switch to left.
9. Fit rear underfloor panels, component protection elements and rear wheels. Carry out short test drive (locks and function of brakes).	

Limit values - locking moment to pressure

Transverse lock



Longitudinal lock



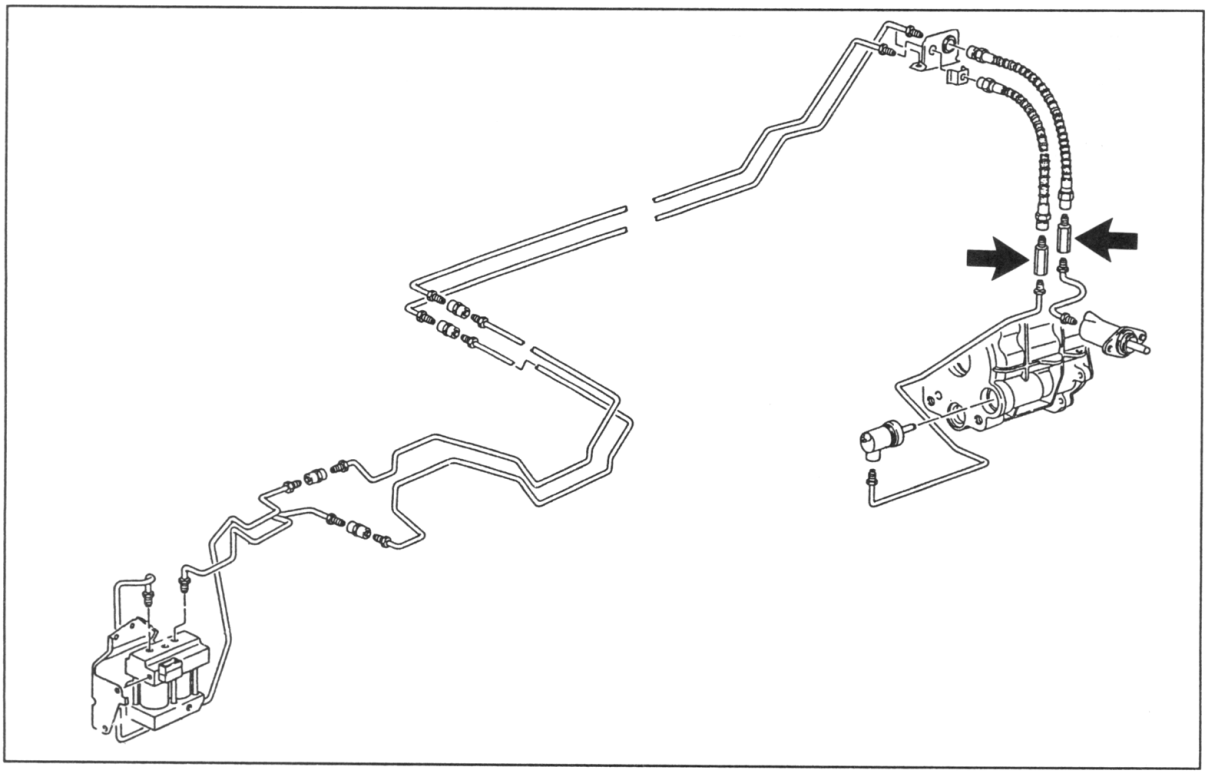
Checking admission valves in locking hydraulics (lock activation)

General

The admission valves are usually also checked when the friction values of the longitudinal and transverse locks are checked (point 4).

One admission valve is located in the pressure lines in front of each of the longitudinal and transverse lock servo cylinders (arrow).

If admission pressure is too high, creaking noises can occur. No pressure is also not good, for reasons of wear and handling dynamics. **When replacement is necessary, do not confuse with PSD admission valve in the 928.**



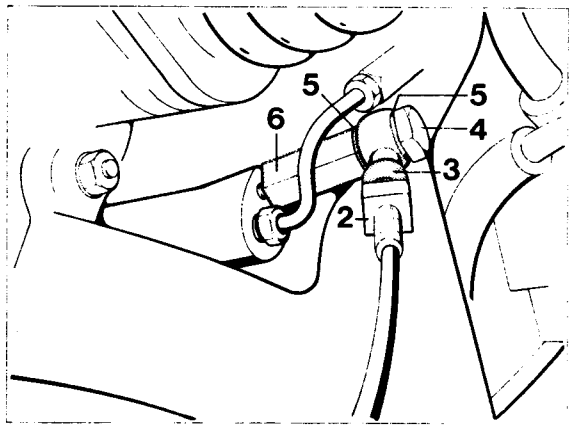
D39/45-39

Prescribed values / differentiating characteristics of admission valves

Type	Presc. value	Difference/marking
911 Carrera 4	approx. 2.0...3.5 bar	2 - 3 stamped on valve
928 with PSD	approx. 3.0...4.5 bar	3 - 4 stamped on valve

Checking admission valves

Procedure	Instructions
1. Prepare vehicle for admission valve check. **To do this:** – Depending on which admission valve is being checked first, connect manometer to relevant lock servo cylinder, first removing ignition key for safety reasons (= no pressure in lines from solenoid valve to admission valves). – Connect System Tester 9288 to diagnosis socket. – Bleed manometer.	– Connect inlet union (No. 3) to measuring line (No. 2). Fit this assembly, in conjunction with inlet-union screw, seal rings and connector (No. 4/No. 5/No.6) **instead of bleed valve on relevant lock servo cylinder**. Connect high-pressure measuring line (No. 2) to manometer. **Important information** Tighten No. 4 and No. 6 carefully, or apply counter-pressure when tightening to avoid misalignment. Failure to observe this precaution could cause connector (no. 6) to break off. Before bleed valve is opened, ensure lock cylinder is not under pressure (e.g. due to full-lock button). For this reason it is best to remove ignition key.



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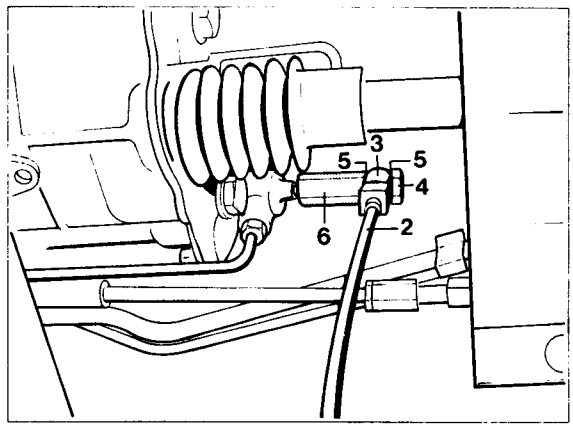


Procedure	Instructions
	- Connect System Tester 9288 (P. D39/45-9). Bleed manometer. To do so, activate locking solenoid valves with System Tester in menue for drive links / bleeding and let off brake fluid from bleed valve until no more air bubbles appear (drain fluid into receptacle). Close bleed valve and press stop button. Move to position for pressure reduction.
	Important information
2. **Check functioning of admission valves as described below:** Using System Tester 9288 activate longitudinal or transverse lock solenoid valve (menue drive links / longitudinal or transverse lock) with 1 - 2 impulses, then move to position for pressure reduction. After a short wait (manometer damping), read off pressure on manometer. **Prescribed values P. D39/45-39**	If admission pressure is too high (before a valve is replaced), again build up a slight pressure and, unlike previous test, cause pressure to fall by switching off ignition. Loss of admission pressure should not exceed 0.5 bar within 5 minutes.
3. After checking, bleed both longitudinal and transverse locks, then correct brake fluid level.	– After removing manometer, select System Tester menue for **drive links / bleeding** and let off brake fluid from bleed valves of longitudinal and transverse lock servo cylinders until no more air bubbles appear. – Disconnect System Tester and correct brake fluid level with pressure reservoir completely full (after pump unit has automatically switched off). **On no account top up above "max. " mark.**

Preventing confusion of longitudinal and transverse lock lines

General

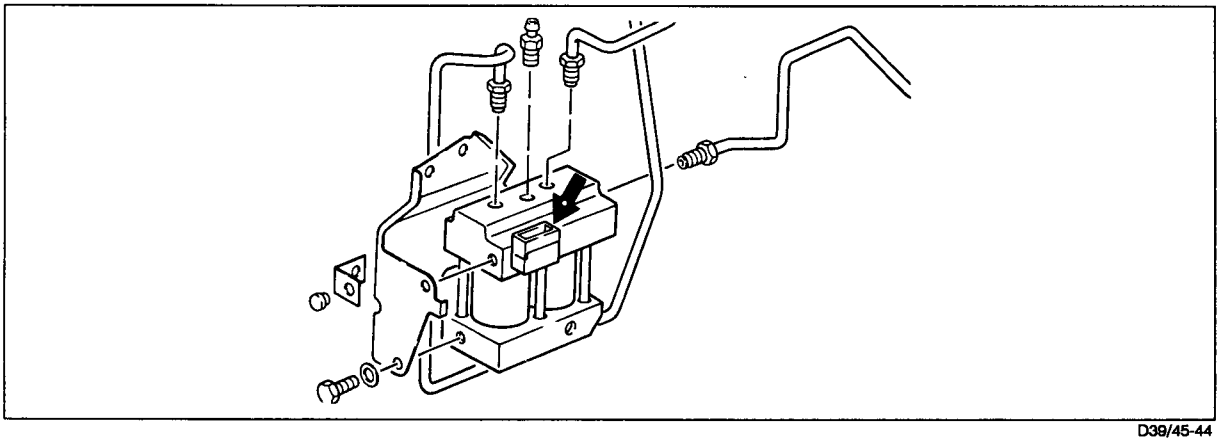
- This test ensures that no electrical or hydraulic lines for lock activation/operation have been mixed up. Such a mix-up could for instance occur following an accident repair for which relevant parts (major components, lines and hoses) have been removed.
- **System Tester 9288 is required for testing.**
- Testing is carried out with vehicle completely jacked up.

Testing

1. Completely jack up vehicle (all 4 wheels free).
2. First check general functioning of transverse lock (correct configuration).
3. Connect System Tester 9288 to diagnosis socket (P. D39/45-9). Switch on System Tester and ignition. Call up PDAS menue for drive links and select "check transverse lock".
   Display shows:
   Transverse lock
   1 = Pressure reduction
   No. of impulses - 0 - .
4. With 0 impulses (display reading) it must be possible to turn rear left-hand wheel. **The rear right-hand wheel must be held immobile during testing**. Input 1st impulse and turn rear left-hand wheel. Input 2nd impulse and turn wheel etc. With increasing number of impulses, wheel should become harder and finally impossible to turn. With any other result (e.g. wheel does not become harder to turn, even though solenoid valve is audibly being activated with each impulse), start with troubleshooting (P. D39/45-44).
5. Check general functioning of longitudinal lock (correct configuration). **To do so, engage parking brake and hold front right-hand wheel immobile during testing.**
6. With the System Tester select "check longitudinal lock" in menue for drive links. With 0 impulses it must be possible to turn front left-hand wheel (front right-hand wheel immobilised). Input 1st impulse and turn wheel, input 2nd impulse and turn wheel etc. **Prescribed reaction:** With increasing number of impulses, wheel should become harder and finally impossible to turn.

Procedure for irregularities

– **First** check whether activation system for lock solenoid valve has been mixed up. To do so, disconnect control unit plug of PDAS/ABS control unit and plug in lock valve block (arrow) with ignition switched off.



D39/45-44

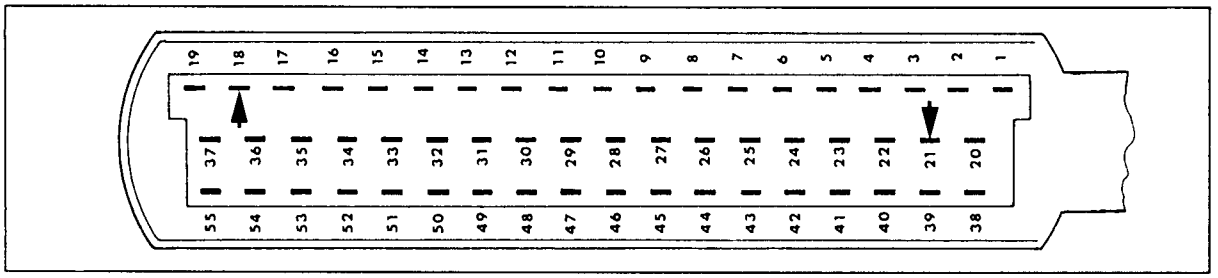
– Carry out continuity test (Multimeter)

Prescribed continuity between:

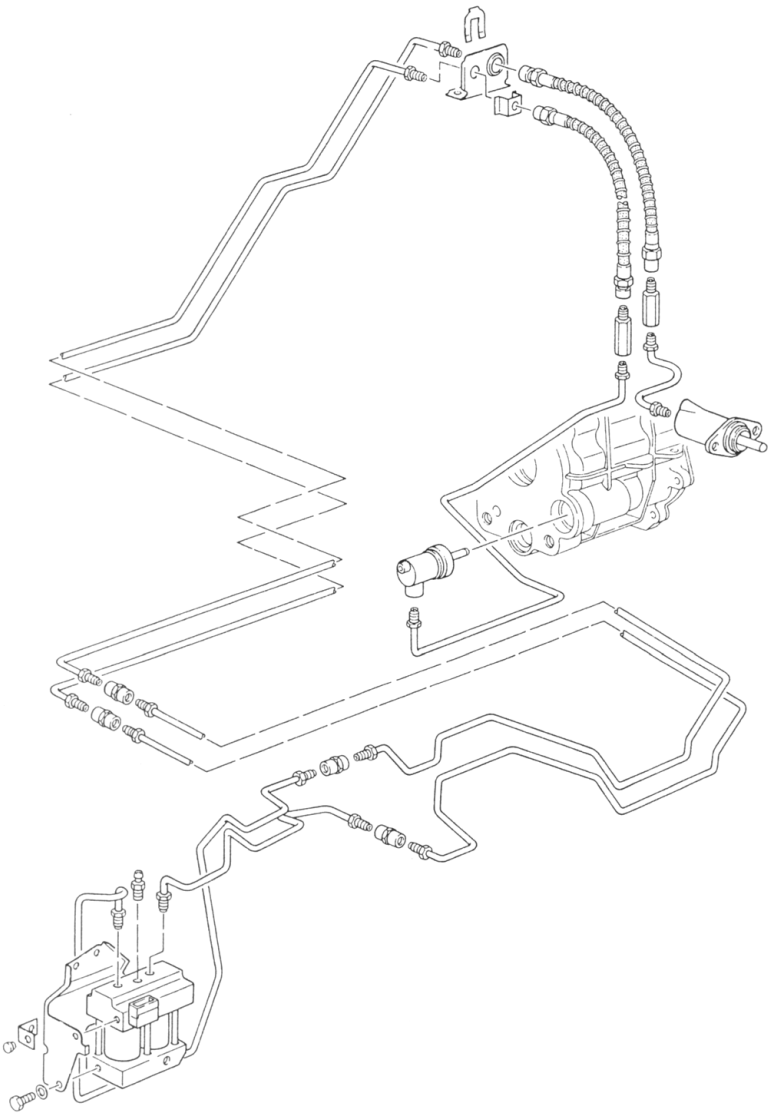
PIN 21 on control unit plug and **PIN 3** on solenoid valve plug = line for transverse lock activation

PIN 18 on control unit plug and **PIN 4** on solenoid valve plug = line for longitudinal lock activation

PIN Nos. 1...4 for the solenoid valves are marked on the solenoid valve plug and the valve block.



– **If this check is in order**, the hydraulic lines from the valve block (solenoid valves for longitudinal and transverse locks) to the lock servo cylinders have been mixed up.



– **After rectifying this error, carry out another check with the System Tester for additional confirmation.**

Tightening torques for mechanical brake system

Location	Thread	Tightening torque Nm (ft.lb.)
Brake calipers to front and rear axles	M 12	85 (62.5)
Brake disk to wheel hub (front and rear axle)	M 6	5 (3.5)
Brake cover plate to front and rear axles	M 6	10 (7.5)
Speed sensors front and rear axle	M 6	10 (7.5)
Ball pin to brake push-rod	M 10	35 (26)
Wheel to hub	M 14	130 (96)

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Technical Data

The technical data are valid for the 911 Carrera 4 and 911 Carrera 4 Turbo Look.
C4 TL = 911 Carrera 4 Turbo Look.

Designation		Remarks, dimensions	Wear Limit
Service brake (foot-operated)		Hydraulic dual circuit brake system with front/rear axle brake circuit division. Hydraulic brake booster, inboard vented brake discs with four-piston fixed calipers front and rear. The pushrod circuit is applied to the front axle. ABS standard.	
Brake booster		hydraulic	
Boosting factor		4.8	
Brake master cylinder	Ø front	23.81 mm	
	Ø rear	23,81 mm	
	Stroke	20/12 mm	
Brake force regulator			
Switchover pressure reducing factor			
	C4	55 bar – 0,46	
	C4 TL	33 bar – 0,46	
Brake disc Ø	front	298 mm	
	rear	299 mm	
Effective brake disc Ø	front	248 mm	
	rear C4	246 mm	
	rear C4 TL	249 mm	
Piston Ø in brake caliper			
	front	2 x 40 + 2 x 36 mm	
	rear C4	2 x 30 + 2 x 28 mm	
	rear C4 TL	2 x 34 + 2 x 30 mm	
Brake pad area			
	front	172 cm^2	
	rear	172 cm^2	
Total brake pad area		344 cm^2	
Pad thickness	front	approx. 12 mm	2 mm
	rear	approx. 12 mm	2 mm

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Description	Remarks, Specification	Wear Limits
Brake disc thickness (new), front	28 mm	
rear C4	24 mm	
rear C4 TL	28 mm	
Brake discs Minimum thickness* after machining		
front	26.6 mm	26.0 mm
rear C4	22.6 mm	22.0 mm
rear C4 TL	26.6 mm	26,0 mm
Max. brake disc thickness tolerance	0.02 mm	
Max. brake disc lateral runout	0.05 mm	
Lateral runout of wheel hub, max.	0.05 mm	
Max. lateral runout of brake disc in installed state	0.1 mm	
Max. peak-to-valley surface finish after machining	0.006 mm	
Push rod play (measured on brake pedal plate)	approx. 8 mm	
Parking brake	mechanical via brake drums on both rear wheels	
Brake drum Ø	180 mm	181 mm
Brake shoe width	25 mm	
Brake liner thicknesss	4.5 mm	2 mm

* Brake discs may only be machined symmetrically, i. e. uniformly on both sides.

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Checking Thickness of Brake Pads

Note

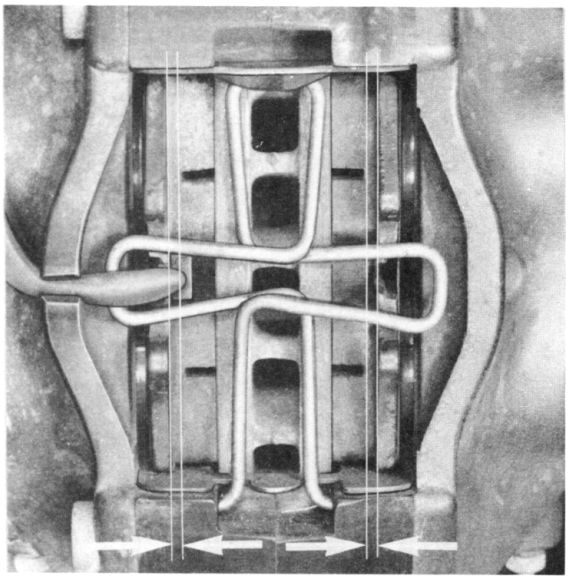
All brake pads on one axle must be replaced when the brake pad wear warning lamp lights up or at the latest, however, with a residual pad thickness of 2 mm.

If the warning lamp reports brake pad wear, the warning contact (sender incl. electric lead and plug) must also be replaced. Replacement of the warning contact can be prevented by replacing the brake pads at the latest when worn to a thickness of 2.5 mm. Warning contacts with a ground electric lead core must be replaced. Replacement is not necessary, however, if only the plastic part of the warning contact is ground.

1. Remove wheels to check the brake pads.

2. Check brake pads visually for wear.

Wear limit has been reached when a pad is worn to a residual thickness of 2 mm.



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Removing and Installing Brake Pads of Four Piston Fixed Caliper Brakes

Notes

Brake pads are replaced in the same manner as for other Porsche vehicle types with four piston fixed caliper disc brakes. There is only a brief description of procedures for this reason. However, always pay attention to the following points.

- **Use specified brake pads (see Parts Catalog).**

- **Replace damping plates each time brake pads are replaced.**

- Damping plates are covered with an adhesive and protective sheet.
  This protective sheet must be pulled off prior to installation.

- **Pad backplates (backs of brake pads) must not be lubricated with grease.**

Removing

- Compress cross spring in the middle and take it out of the holder. **Press (release) cross spring in area of holder in direction of the brake disc at the same time or before the beginning of compression.** Damage on the holder is prevented in this manner.

- Move out warning contact on the brake caliper and pull warning contact out of the brake pad plate.

Note

Replace warning contacts with ground or ground through electric lead cores. A warning contact can be reused when only the plastic part has traces of grinding.

- Pull out brake pads with a brake pad impact puller and **always** conform with the following points.

  Move out brake pads together with the damping plates. Insofar as this is not possible (depending on the wear condition of brake pads), loosen the damping plates on the brake pad backplate with a spatula prior to removal of the pads. First set back the brake pads with a piston back setting tool as far as possible in both cases. If applicable, first draw some of the brake fluid out of the supply tank.

Installing

- If applicable, set back piston into neutral position with a back setting tool.

- Clean seating and guiding surfaces of brake pads in the brake calipers with alcohol and a cylindrical or special brush. **Always make sure that the dust caps of brake pistons are not damaged during this step.**

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- Insert **new damping plates** in the pistons. Since damping plates are covered with an adhesive and protective sheet, **this protective sheet must be pulled off** prior to installation.

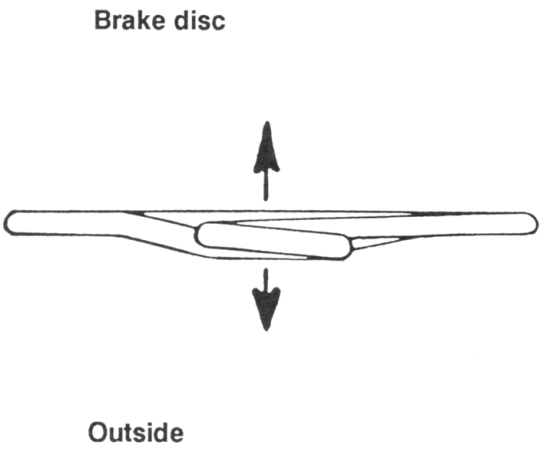
- Insert brake pads. **Check for correct type of brake pads.**

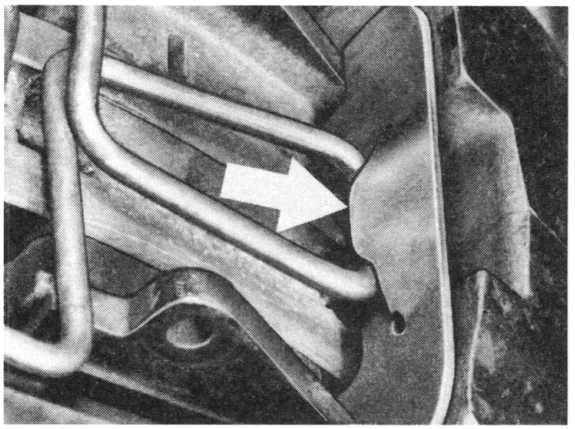
Note

Brake pad backplates (backs of brake pads) must not be lubricated with grease. However, in order to prevent seizure of brake pads in the brake calipers due to corrosion, give the seating and guiding surfaces a thin coat of grease.
Use Optimoly HT (copper paste or Plastilube (Schillings, P. O. Box 1703, D-7080 Aalen) for this purpose.

- Lubricate attachment eyes of the cross springs with Optimoly **TA** or Plastilube.

If applicable, mount a new cross spring that its flat side faces the brake disc.
Make sure that the cross spring engages correctly (arrow). Never engage the spring with force (danger of damaging holder).





- Insert warning contact lead and warning contact. If necessary, disengage the cross spring again for this purpose.

- Operate brake pedal of a stopped car firmly several times to move the brake pads into the seating equal to that of operating state.
Turn on ignition and operate brake pedal so often until the electric pump of the pump (for brake booster and lock control) is heard to run. Check / correct brake fluid level after the pump has been switched off.

Running-in Brake Pads

New brake pads require a running-in time of approx. 200 km (120 miles). Their most favorable friction and wear values are first reached then. During this period the brake should only be used for full-stop braking from high speed in an emergency situation.

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Adjusting Brake Push Rod / Checking Stop Light Switch Adjustment

Adjusting Brake Push Rod

The brake pedal does not have a stop. The permanently set clearance in the brake booster is guaranteed, since with a correctly adjusted brake push rod the brake pedal does not have any support in neutral position. A push rod play **of approx. 8 mm** will be **noticed** on the pedal plate of the brake pedal when operating by hand.

The position of the brake pedal is changed by correcting the push rod adjustment on pivot head (3). In this case it is therefore also necessary to check the stop light switch adjustment.

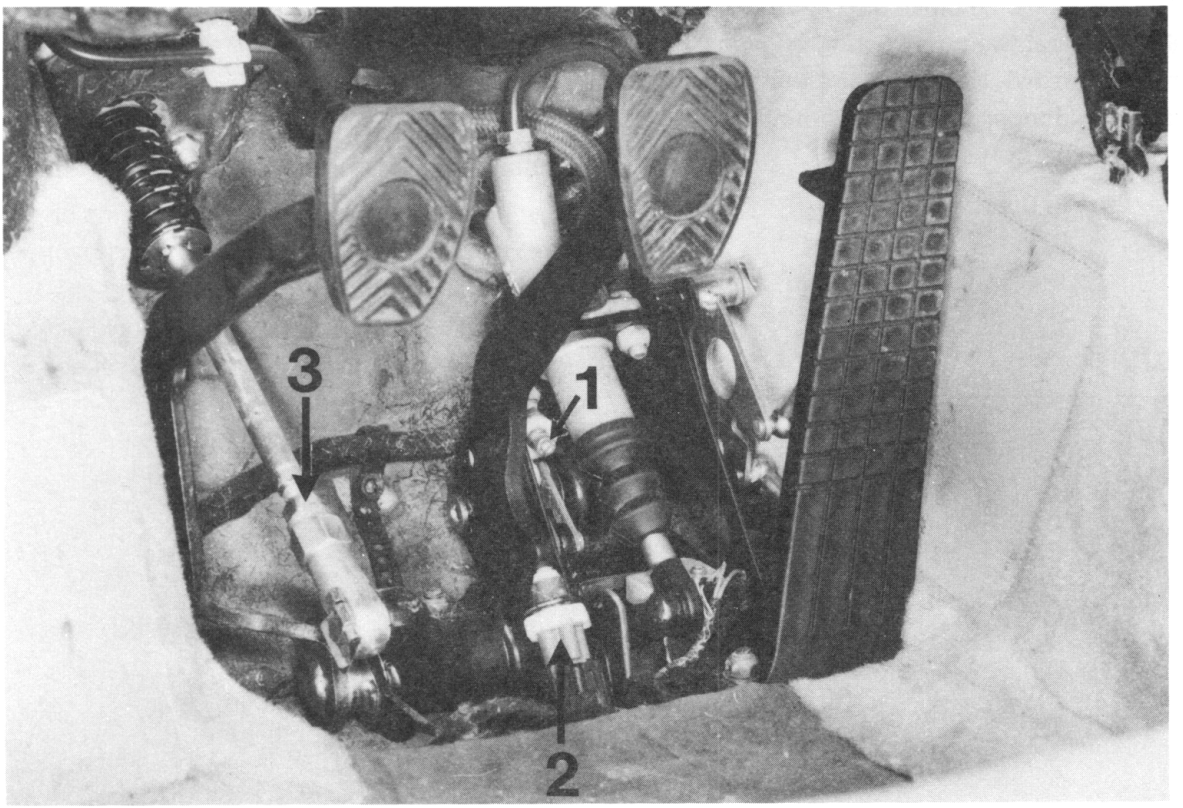
The brake push rod is adjusted correctly, if the brake pedal plate is at the same height (± 3 mm) as the clutch pedal plate (clutch pedal in neutral position).

Checking Stop Light Switch Adjustment

Stop lights must light up after the brake pedal has traveled 6 to 16 mm (measured at the middle of the pedal plate).

If the stop lights light up with less than 6 mm pedal travel, turn stop light switch (2) clockwise until it responds within the tolerance range (electric lead and plug must not be damaged in this step). Insofar as the correction range of the stop light switch is not sufficient, adjust the brake pedal on the pivot head of brake push rod (3) (shorten the push rod).

If the stop lights light up after 16 mm pedal travel, adjust the brake pedal on the pivot head of the brake push rod (lengthen the push rod) until the stop light switch responds in tolerance range.



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Checking and Adjusting Parking Brake

Checking Dead Travel of Parking Brake Lever

The parking brake employs brake liners without asbestos. Basically a parking brake with asbestosless brake liners must never be adjusted in such a manner that the liners must be "ground free" during operation.

Insofar as the parking brake lever can be pulled up more than 4 teeth with application of medium force, without any braking effect, the parking brake must be adjusted.

Adjusting Parking Brake

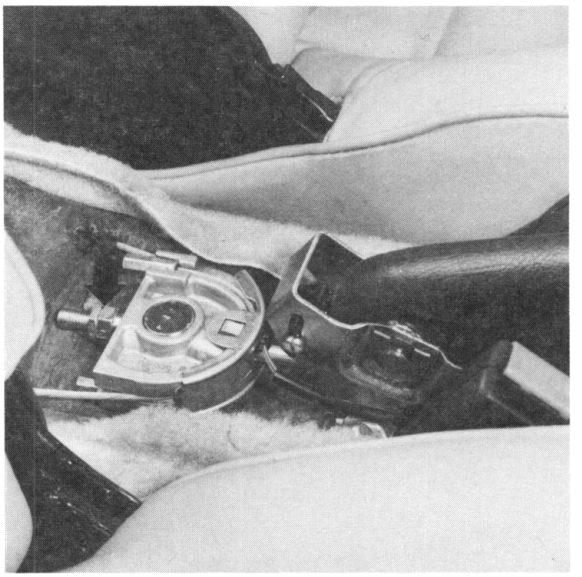
1. Remove rear wheels.

2. Release parking brake lever and push back disc brake pads on the rear axle until the brake disc can be turned easily.

3. Loosen adjusting nuts on the cable holder (arrow) until the cables are without tension.

Note

The cable holder is accessible after removal of the tray behind the parking brake lever (two mounting screws).



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4. Insert a screwdriver through the bore of the brake disc and turn the adjusting device until the wheel can no longer be turned. Turn back the adjusting device afterwards until the wheel can be turned easily. *Then turn back (loosen) by two more catches.*

5. Pull up parking brake lever two teeth and turn adjusting nuts on the cable holder so far that both wheels are hard to turn by hand.

6. Release the parking brake lever and check whether both wheels can be turned easily.

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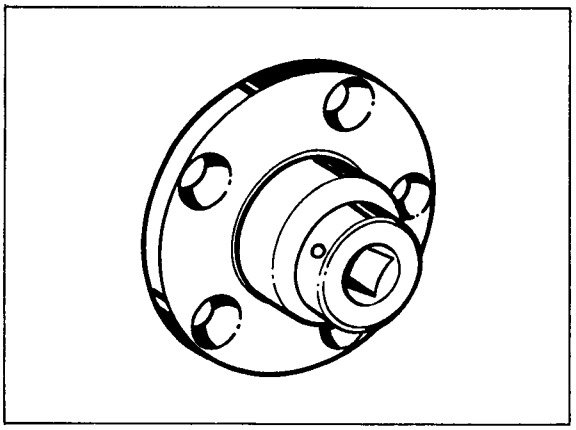
Checking brake disc lateral runout

1. Measuring requirements: No tilt play present at wheel.

2. Fit adapter plate (Special Tool 9510/1) **to wheel hub**. Tightening torque of wheel nuts (mounting nuts): 130 Nm (96 ftlb).



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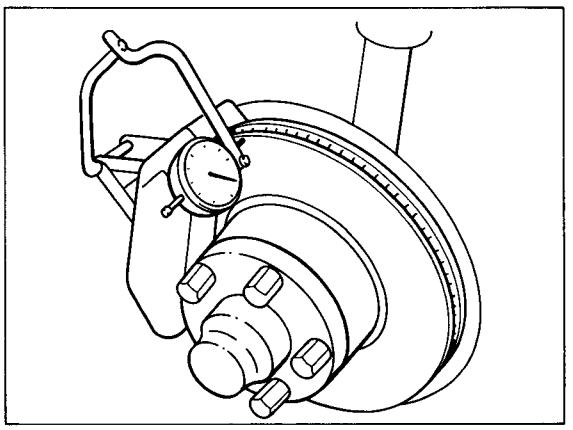
3. Engage dial gauge holder, e.g. Ate Part No. 03.9314-5500.3/01, into brake caliper, determine center position and fit by turning the wing screw.
   If the brake disc cannot rotate freely, push back brake pads slightly.
   Take care not to damage the tab for the spreader spring on the retainer plate of the four-piston fixed calipers when fitting the dial gauge holder.

Note

If required, fit dial gauge holder with Ate conversion kit, Part No. 03.9314-5510.3/01 (longer wing screw and bracket for dial gauge if required).
For two-piston fixed calipers, the brake pads must be removed to allow the dial gauge holder to be fitted.

4. Fit dial gauge with a slight preload. Place measuring pointer on maximum diameter of braking surface.



1036 - 46

5. Rotate brake disc and read off runout on dial gauge.
   Max. permissible lateral runout of fitted brake disc **max. 0.1 mm.**

Note

Lateral runout of removed brake disc : max. 0.05 mm.
Lateral runout of wheel hub : max. 0.05 mm.

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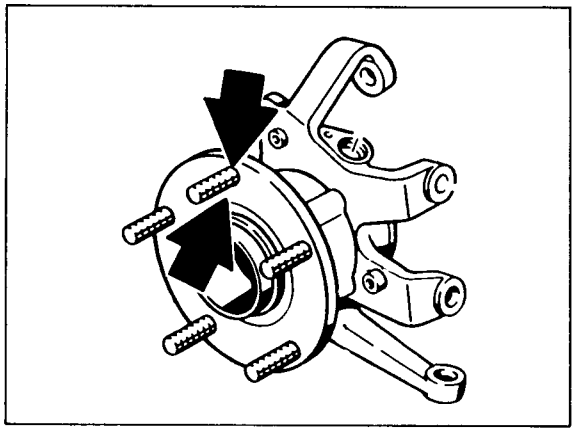
6. If the brake disc runout exceeds 0,1 mm, remove the brake disc and check lateral runout of the wheel hub. Mark position of disc with regard to wheel hub.

7. Check wheel hub runout as follows:
Measure once outside (arrow) and once within wheel stud area of hub face.
To fit the dial gauge, use either a magnetic universal dial gauge holder or the dial gauge holder VW 387.

Note

Make sure the brake hoses and brake pipes are not damaged when the brake caliper is removed and installed.



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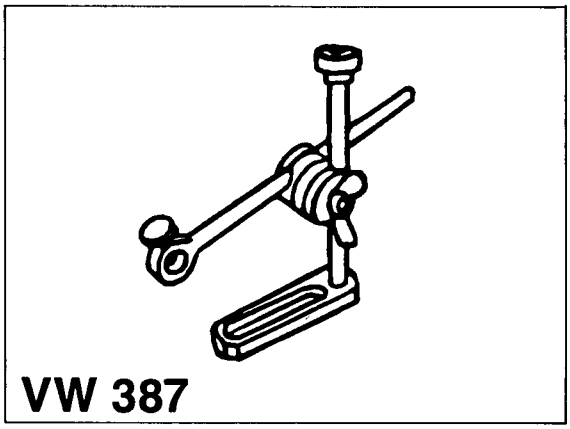

1039 - 46

8. **Excessive lateral runout of wheel hub:**
Replace wheel hub.
Lateral runout of wheel hub o.k.:
Clean leveling and centering surfaces of brake disc and wheel hub. Then coat centering surfaces of wheel hub with a thin coat of Optimoly TA.
Fit brake disc to wheel hub in another position, offset radially with regard to wheel hub.
Repeat measurements with fitted adapter plate - Special Tool 9510/1.
If the lateral runout is still in excess of 0.1 mm, the brake disc must be replaced.

Note

If the brake disc runout has been reduced by offsetting the brake disc radially with regard to the wheel hub, one 6 mm screw may be omitted if two 6 mm countersunk screws had been fitted.

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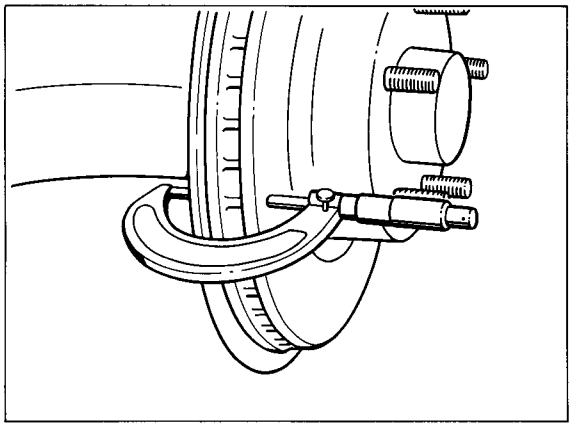
Checking brake disc thickness

Measure brake disc thickness in approx. 8 places within the braking surface using a micrometer.



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Dismantling and assembling front brake

Dismantling

1. Remove brake caliper (do not disconnect brake hose or brake line / remove brake hose retainer from spring strut).

2. After removing the countersunk head screw(s), take off brake disc. If the brake disc is binding and cannot be freed with light plastic hammer blows, screw two hexagon head bolts evenly into both 8 mm threads of brake disc and press off brake disc.

Assembly

1. Check condition of all components and replace if required.

2. Clean end face and centering surface of brake disc and wheel hub. Coat centering surface of wheel hub with a thin coat of Optimoly TA.

3. Fit brake disc.

Note

Be careful not to confuse right-hand and left-hand brake discs on Turbo - Look vehicles during reassembly.
The discs may be identified by their involute shape and part number. The part number is indicated on the brake disc.

Left-hand spare part -
3rd group number: uneven digit

Right-hand spare part -
3rd group number: even digit

Example:

- Part No. for left-hand brake disc: 965.351.043.00

- Part No. for right-hand brake disc: 965.351.044.00

4. Fit brake caliper. Tighten brake caliper bolts to 85 Nm (63 ftlb.).
Check for correct position of brake hose and brake line.

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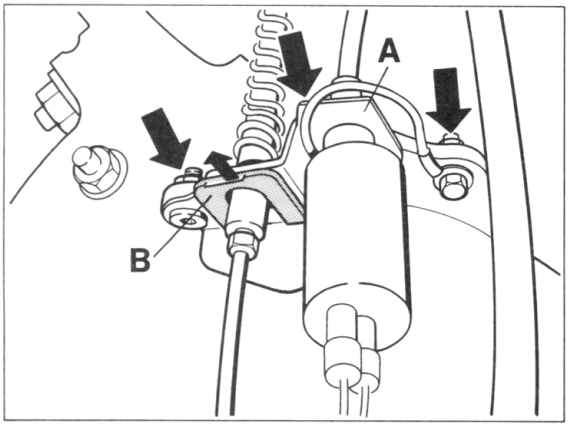
Dismantling and assembling rear brake

Dismantling

1. Remove brake caliper (do not open hydraulic brake system).
   To do so, remove ground wire and bracket (A) from left-hand rear-axle trailing arm (arrows). Before starting work, extend brake hose retainer (B).
   This allows the brake line or brake hose, respectively, to remain sealed when the brake caliper is fitted.



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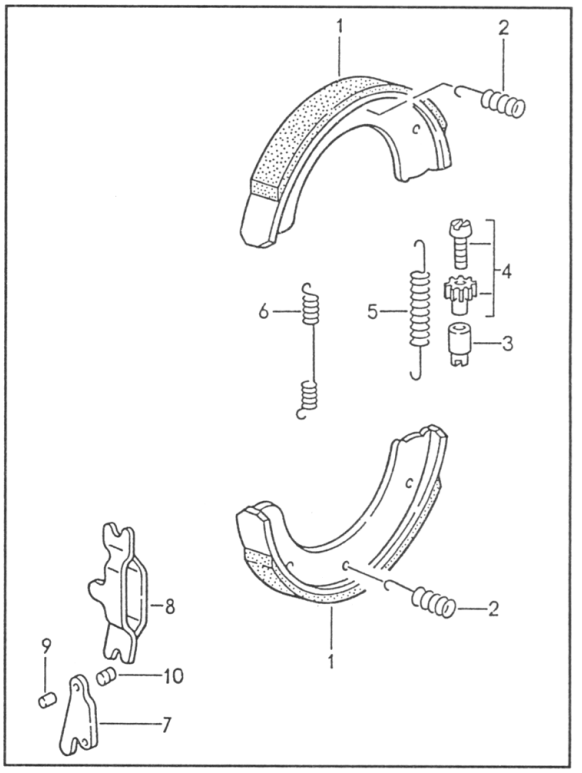
Note

If the wheel hub must be removed (not required for replacement of parking brake shoes), undo hexagon head nut on drive shaft before removing the brake caliper.

2. Engage a screwdriver into the hose in the brake disc and turn adjuster in the “slackening” direction. Lift off brake disc after removing the countersunk head screw(s).

3. Remove thrust springs (No. 2), adjuster (No. 3/4) and return spring (No. 5). Remove parking brake shoes and return spring (No. 6).



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Assembly

1. Apply a thin coat of grease to adjuster (No. 3/4), operating lever pin (spreader lever) and sliding surfaces of parking brake shoes.

2. Install operating lever (spreader lever), brake shoes, return springs, thrust springs and adjuster.

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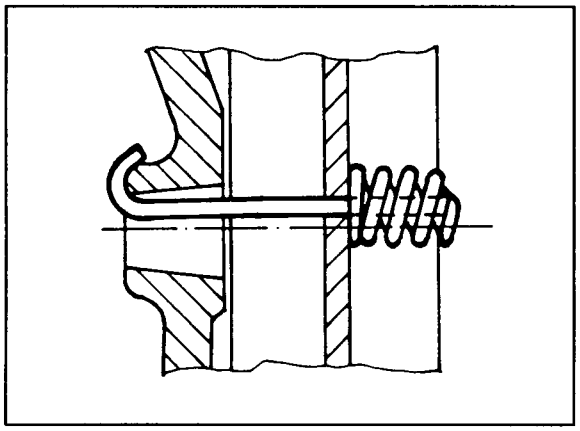
Note

Make sure the hooks (curved spring ends) of the thrust springs are seated correctly around the flange of the wheel carrier (if required, use a mirror to check).

Correct assembly



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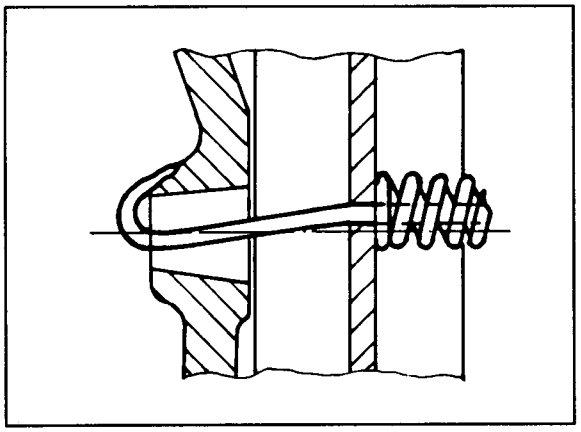
Incorrect assembly



764/1

3. Check parking brake shoes, adjuster, return springs, thrust springs and spreader lever once more for correct seating, making corrections as required.

4. Clean end and centering surfaces of brake disc and wheel hub. Coat centering surface of wheel hub with a very thin coat of Optimoly TA.

5. Fit brake disc.

Note

Be careful not to confuse right-hand and left-hand brake discs on Turbo-Look vehicles during reassembly.
The discs may be identified by their involute shape and part No. (refer to front brake, p. 46 - 11)

6. Adjust parking brake (p. 46 - 5).
   Fit brake caliper. Tighten mounting bolts to 85 Nm (63 ftlb.).

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Tightening torques for brake hydraulics

Location	Thread	Tightening Torque Nm (ftlb)
Booster circuit (brake pressure booster and differential lock control)		
Steel pressure pipe at pressure reservoir, brake booster, valve block and pump assembly	10 x 1	14 - 16 (10 - 12) (steel pipes)
Copper pressure pipe at valve block, hose and lock cylinder	10 x 1	12 - 14 (9 - 10) (copper pipes)
Return line at valve block (hollow screw)	M 10 x 1	16 (12)
Threaded coupling (miniature measuring union) at pressure reservoir	M 10 x 1	14 - 16 (10 - 12)
Master cylinder circuits		
Brake pressure pipe at master cylinder, brake hose, brake pressure regulator, distributor, brake caliper and hydraulic unit	M 10 x 1	12 - 14 (9 - 10) (copper pipes)
Brake power controller to angle bracket	M 10 x 1	14 (10)
Brake caliper		
Connecting pipe at brake caliper	M 10 x 1	12 (9)
Bleed valve at brake caliper	M 10 x 1	8 - 12 (6 - 9)

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Location	Thread	Tightening Torque Nm (ftlb)
Pump assembly		
Pump assembly mount	M 6	10 - 13 (7 - 10)
Pressure warning switch on pump assembly	M 25	26 (19)
Brake booster		
Screw plug in master cylinder	M 10 x 1	12 - 16 (9 - 12)
Brake pressure regulator to bulkhead	M 8	23 (17)
Master cylinder to adapter* on brake booster	M 8	23 (17)

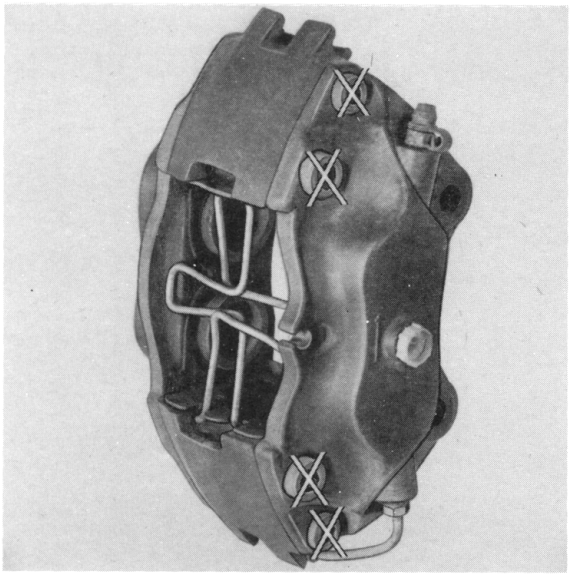
* Do not dismantle this adapter

Information About Four Piston Fixed Calipers

Installation Notes

Brake caliper sections must never be separated.

Piston seals, dirt scraper rings and spring plates can be replaced on an assembled fixed caliper.
Heat mounting screws to about 150° C (300° F) with a hot air blower to remove the spring plates, since the screws are installed with a cement. Use new screws for installation. Coat screw threads lightly with Loctite No. 270.
Brake cylinder paste Unisilikon TK 44 N 2 must be used for the installation of brake pistons.
(This is also applicable **retroactively for other brake calipers** when repairing.)
Unisilikon paste is available from Parts (Part No. 000.043.117.00).



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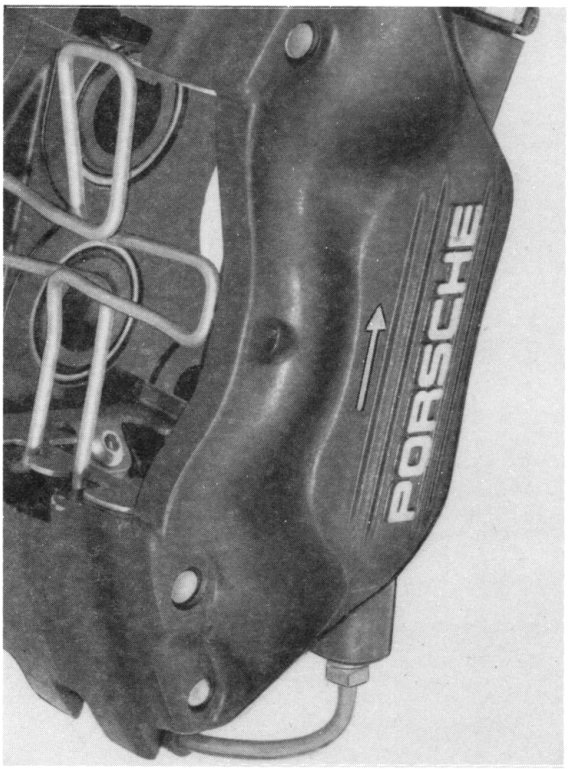
X = Screws – never loosen or tighten

In order to be able to check the installed position of brake calipers with installed brake pads, fixed calipers have an arrow indicating the brake disc's direction of rotation above the Porsche trademark.



11582

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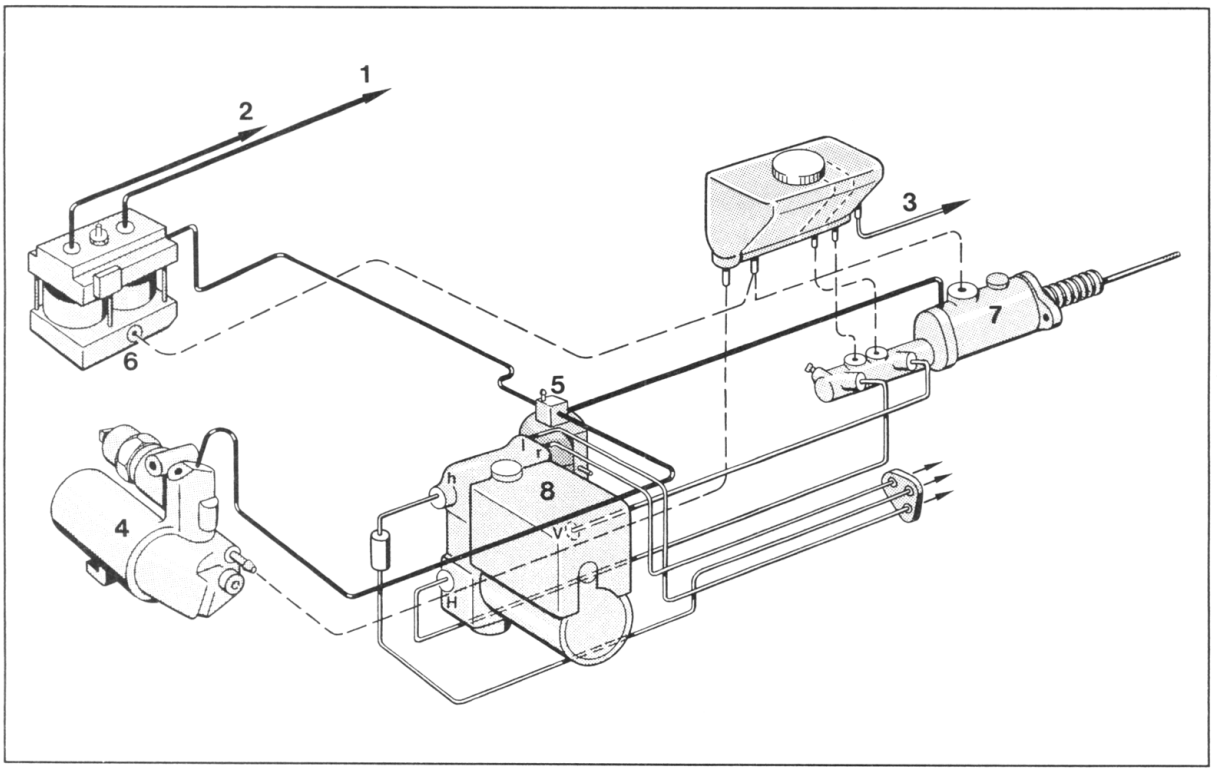
Replacing Brake Fluid / Bleeding Brakes and Lock Control

General Information

Since brake master cylinder circuits, consisting of the push rod circuit (for front axle) and intermediate piston circuit (for rear axle) with the ABS hydraulic control unit, are completely independent of the booster circuit (brake booster and lock control), brake fluid replacing and bleeding procedures are divided into different jobs (see next page).



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═══	Brake master cylinder circuits (exception 3)
▬▬▬	Booster circuit (brake booster and lock control)
- - - - -	Return / feed or intake end
1 + 2	To axial and lateral lock cylinders (Q and L)
3	Feed to clutch master cylinder
4	Pump assembly
5	Pressure reservoir
6	Valve assembly (solenoids for axial and lateral locks)
7	Brake booster
8	ABS hydraulic control unit

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Information

- Use only new brake fluid DOT 4.
  Total brake fluid change quantity approx. 1.6 l.

- **Brake fluid change interval and fluid grade have been modified as of MY '93.** For details, refer to page 47 - 101 (911 Carrera 2).

- The brake fluid reservoir is subdivided into chambers approx. as from the middle section downwards.

Procedure/subdivision

1. Brake fluid change (brake, lock control and clutch) /
   Bleed brake master-cylinder circuits*.

2. Bleed lock cylinders and pressure lines *insofar as the hydraulic system was opened after the valve block for lock actuation.*

3. Bleed the lock or brake booster circuit *insofar as parts of the booster circuit were replaced or if the system (also suction side of the pump assembly) was opened.*

Further to 1: (Brake fluid change)*

The brake fluid change is subdivided into two steps.

1st step: Change brake fluid of the brake master-cylinder circuits and clutch hydraulics (conventional). Also valid for bleeding of the brake master-cylinder circuits and clutch hydraulics.

2nd step: Change the brake fluid of the booster circuit (brake booster and lock control). Operate the lock solenoid valve with system tester 9288 and remove brake fluid at each lock cylinder.

* Bleeding the brake master-cylinder circuit and the clutch hydraulics:
Same procedure as for 1st step for the brake fluid change.

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Use of an electric filling and bleeding machine is recommended to guarantee fast and practical **replacement of the brake fluid**.

- Pour new brake fluid in the supply tank until the level reaches the upper edge. Connect bleeder on the supply tank. **Clamp the overflow hose (venting) with a hose clamp.** Switch on bleeding machine.

- A bottle must be used to catch the escaping brake fluid and therefore be able to check it for dirt and air bubbles as well as to determine the brake fluid consumption. Change volume for each wheel: approx. 250 cc. Bleed on both bleeder valves of each wheel.

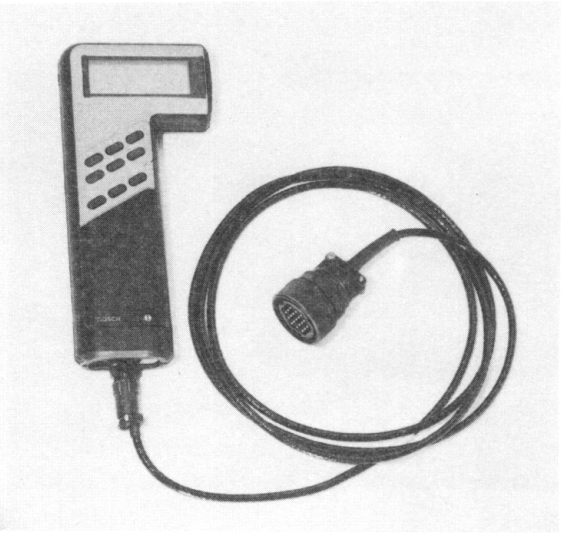
- Also drain about 50 to 100 cc of brake fluid on the bleeder valve of the clutch slave cylinder.

- **Switch off and disconnect the bleeding machine.** Remove hose clamp on the overflow hose (venting).

Note

The rear underside trim panel must first be removed for the next step (booster circuit). If applicable for reasons of space, unscrew and also remove the engine splash guard. In addition, the battery should be in well charged condition.

- Connect System Tester 9288 in conjunction with connecting lead 9288/1 in the diagnostics socket in the passenger's footwell (underneath a cover). **Turn on ignition and tester. Select type of vehicle and PDAS system afterwards. Then go into the drive menu.**



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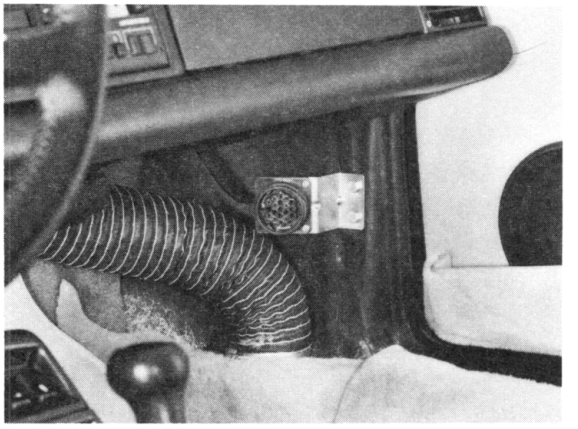

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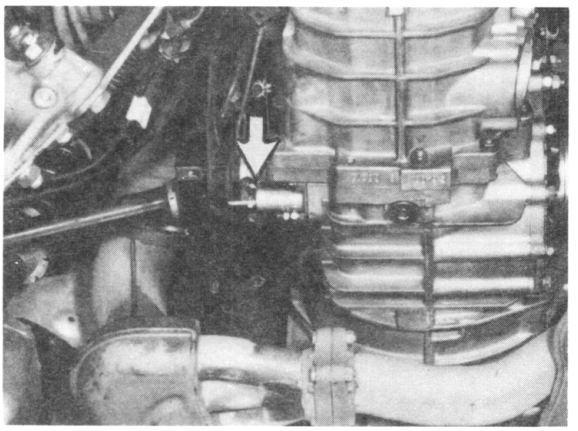
- **Select the bleeding position in the drive menu**. Unscrew bleeder valve on the lateral lock cylinder and **drain about 250 to 300 cc (max. 300 cc) of brake fluid** after pressing the start key displayed in the tester.
  Press stop key and tighten the bleeder valve.
  Go into the pressure discharging position with the tester.



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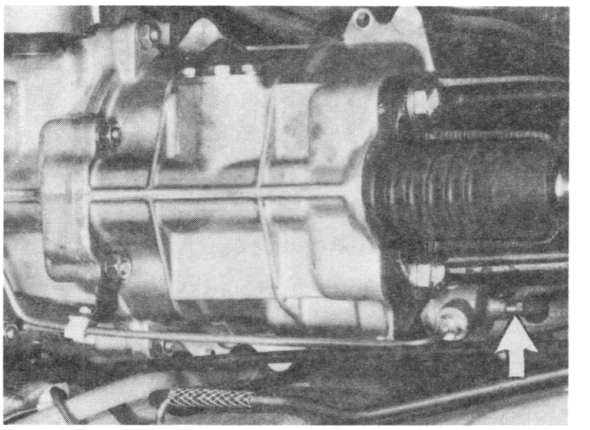
- **Pour in new brake fluid.** Operate the brake pedal several times while the ignition remains turned on.

- Afterwards activate the solenoids again with a 9288 System Tester (bleeding position in the drive menu) and **drain about 200 cc of brake fluid** on the bleeder valve of the **axial lock cylinder**.



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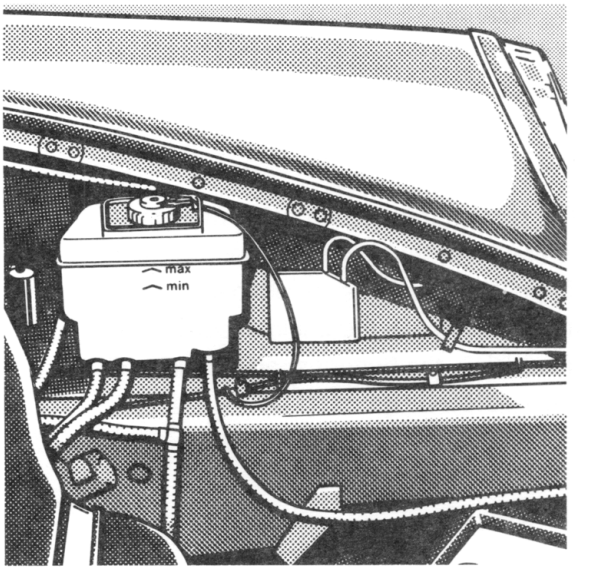
- Disconnect system tester.

- Correct the brake fluid level.
  This requires operating the brake pedal first so many times (with the ignition on) until the pump assembly is operated.
  Correct the brake fluid level only after the pump assembly has been switched off.
  Never pour in so much brake fluid that the level is above the "max." mark.



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Further to 2: (Bleeding the lock cylinders and pressure lines)

Information

These instructions apply only if:

- the longitudinal or transverse lock cylinder has been replaced
- the hydraulic system was opened after the valve block (solenoid valves for longitudinal and transverse locks)
- it is suspected that the bleeding condition of the lock control (lock actuating) is not optimum.
  Explanation:
  Checking of the bleeding condition in the workshop is too time-consuming or not possible. For this reason, perform bleeding again if in doubt.

If the pump assembly, pressure accumulator or the valve block has been replaced or removed, these instructions are not sufficient. Other work must be performed previously.
Description as from Page 47-6.

The underbody cladding must be dismantled at the rear for the following steps.
For space reasons, undo or also dismantle the assembly under-protection if necessary.
In addition, the battery should be in well-charged condition.

Bleeding

- Fill the fluid reservoir with new brake fluid up to the top edge.
- Connect the system tester 9288 to the diagnosis socket (right in the passenger footwell) with the connecting cable 9288/1.
- **Switch on ignition and tester. Select vehicle type and then the system PDAS. Go into the drive link menu.**
- **Select the item "Bleeding" in the drive link menu.** Open the bleeder valve on the transverse lock cylinder and remove brake fluid after pressing the start key indicated by the tester.
  Continue bleeding until brake fluid free of air bubbles emerges (max. 300 cm^3).
  Press the stop key and close the bleeder valve.
  Change to pressure reduction position with the tester.
- **Fill with the new brake fluid (depending on quantity removed).**
- Then operate the solenoid valve again with the system tester 9288 (in the drive link menu / item "Bleeding") and **also remove brake fluid at the bleeder valve of the longitudinal lock cylinder until the fluid is free of air bubbles (remove max. 300 cm^3).**
- Disconnect the system tester and correct the brake fluid level (refer to Page 47-4). **Do not fill over the "max. marking" under any circumstances.**

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Further 3: (Bleeding the lock or brake booster circuit)

Information

Bleeding is divided into three steps. The first step can be omitted where appropriate.

1st step: Preparatory measures for first assembly or re-installation

2nd step: Bleeding the pressure accumulator and the valve block

3rd step: Bleeding the lock cylinders and pressure lines (as on Page 47 - 5)

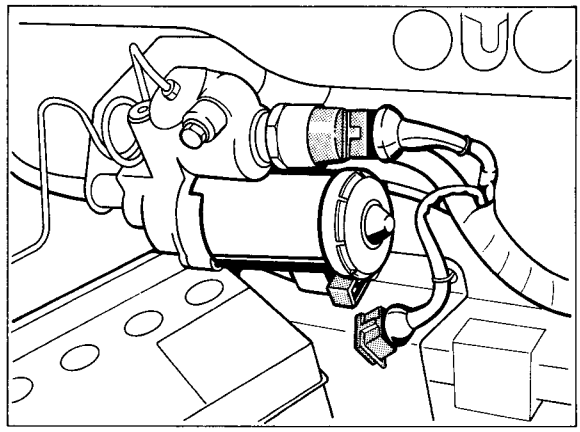
In the case of replacement or removal of the pump assembly, pressure accumulator and valve block, these instructions (procedures) must be observed exactly. If a different procedure is followed, heavy foaming of the brake fluid may occur.

When working on the booster circuit (for removal and installation of corresponding parts), first depressurize this circuit.
To do this, disconnect the electrical plug on the pressure pump (pump assembly) (refer to drawing 348-47) and then operate the brake pedal approx. 25 times.
To remove and plug in the electrical plug, press in the center on the plug locking clip.

Preparatory measures for
first assembly or reinstallation

This work step (1st step) is required only in the event of replacement or re-installation of the pump assembly, pressure accumulator and valve block. In addition, it is also necessary if the suction line has been opened or if the fluid reservoir was previously empty. Otherwise, start with the 2nd step. (Bleeding the pressure accumulator and the valve block).

- Ensure that the electrical plug at the pressure pump (pump assembly) has been disconnected.



348-47

- Immediately after assembly of the parts, fill the fluid reservoir with new brake fluid up to the top edge. Connect the bleeding device to the fluid reservoir.
  Clamp off the overflow hose (ventilation) with a hose clamp.
  Switch on the bleeding device. Bleeding pressure approx. 1.5 bar.

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Note

The brake pedal must not be operated as long as the bleeding device is connected, otherwise the return line may be forced out of the rubber plug of the brake booster.

Continue with bleeding the pressure accumulator and valve block.

Bleeding the pressure accumulator and valve block (step 2)

If step 1 was not performed, discharge any accumulator pressure. To do this, disconnect the electrical plug at the pressure pump (pump assembly) and **slowly open** the bleeder valve at the pressure accumulator with connected collection bottle.
Hold the bleeding hose firmly.

Caution:

A pressure of up to 180 bar exists at the bleeder nipple of the solenoid valve and also at that of the pressure accumulator. Open the bleeder valve only very carefully. Ensure that the bleeder hose is securely fitted!
Wear protective goggles and protective gloves.

If not already done (if the system was already depressurized), **connect the collection bottle to the pressure accumulator bleeder valve and open the valve.**

Move the steering/ignition-starter lock to position 1 (necessary for pump operation). Plug the electrical plug onto the pump. As soon as no air bubbles are visible any more at the transparent bleeder line of the collection bottle, disconnect the electrical plug and close the bleeder valve.

Note

Insofar as the filling and bleeding device is not connected (is required only for step 1), always check the fluid level in the fluid reservoir between the bleeding operations and top up with new brake fluid if necessary.

Open the bleeder valve at the valve block. Plug the electrical plug onto the pump. Disconnect the electrical plug and close the bleeder valve as soon as the brake fluid emerges without air bubbles.

Now completely fill the pressure accumulator (bleeder valves closed). For this purpose, connect the electrical plug. As soon as the pump has audibly switched off, **disconnect the electrical plug** and completely discharge the pressure at the bleeder valve of the pressure accumulator. Slowly open the bleeder valve and hold the bleeder hose tightly.
Caution: A pressure of up to 180 bar is present.
Wear protective goggles and protective gloves.

Repeat the last operation (completely fill the pressure accumulator and then completely drain the accumulator pressure) approx.. 1-2 times (brake fluid must be free of air bubbles).

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- **Also bleed the valve block in the same way (as for the pressure accumulator) approx. 1-2 times.**

- When it is guaranteed that bleeding has been performed so that there are no longer any air bubbles, securely tighten the bleeder valves and plug the electrical plug onto the pump.
  Ensure that the plug engages properly.

- **Switch off the bleeding device if appropriate and disconnect. Also remove the hose clamp from the overflow hose (ventilation).**

- Press the brake pedal several times. (The bleeding device must not be connected.)

- Continue with bleeding the lock cylinders and pressure lines.

Bleeding the lock cylinders and pressure lines (step 3)

In the following work step, the solenoid valves are operated with the system tester 9288. The high pressure present at the solenoid valves is thus supplied in pulse form into the pressure lines and to the lock cylinders via the check valves.
Remove brake fluid at the bleeder valves of the lock cylinders until no air bubbles appear anymore. (Top up fluid reservoir in between if necessary).

The exact work sequence is described on Page 47-5.

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Pressure tests on the booster circuit

Overview

1. General

2. Pressure gauge connection

3. Tests

4. Nominal values / Notes

1. General

The following points can be checked by means of the pressure test on the booster circuit (brake booster and block control):

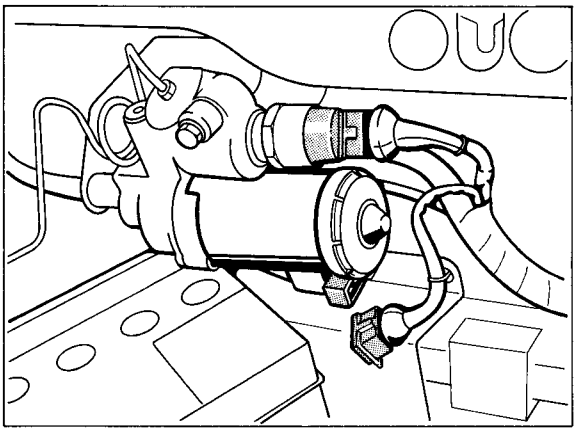
- Freedom from leaks of the booster circuit (any internal leak can thus be localized)

- Gas filling pressure of the pressure accumulator

- Switching points for the booster circuit (brake pressure warning lamp and operating pressure). This is controlled by the pressure warning switch of the pump assembly.

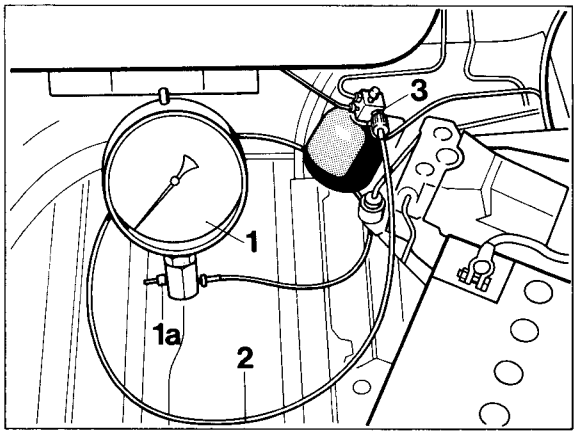
2. Pressure gauge connection

- Depressurize the booster circuit. To do this, disconnect the electrical plug at the pressure pump (pump assembly) and then press the brake pedal approx. 25 times. The system is depressurized as soon as the brake pedal feels hard when operated. In order to disconnect and plug the electrical plug onto the pressure pump, press in the center on the plug locking clip.



348-47

- Connect pressure gauge 9509 (No.1) at the screw coupling (mini measuring connection No. 3) of the pressure accumulator with the high-pressure measuring line 9509/2 (No.2).



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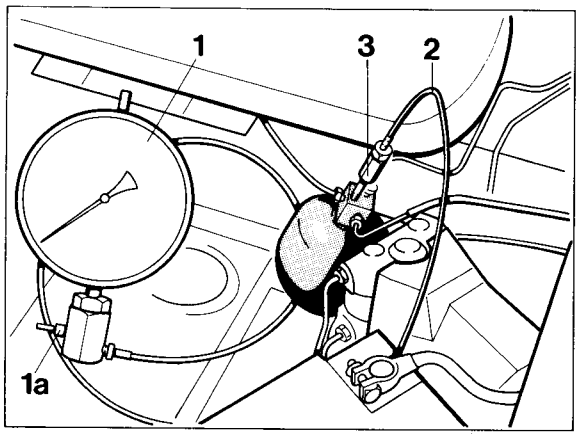
- **In the case of pressure accumulators without mini measuring connection,** connect the high-pressure measuring line 9509/1 (No.2) with adapter M 8 (No. 3) at the pressure accumulator instead of the bleeder valve.
  To do this, undo the pressure accumulator slightly if necessary. The adapter M 8 (No. 3) must be taken from the pressure testing device for braking-force regulator testing.



372-47

- **Bleed the pressure gauge (No. 1).** To do this, connect a collection bottle to the pressure gauge bleeder valve (No. 1a) and open the valve.
  Move the ignition key to position 1 (necessary for pump operation).
  Plug the electrical plug onto the pump. **Disconnect the electrical plug and close the bleeder valve** as soon as no air bubbles are visible anymore at the transparent bleeder line of the collection bottle.

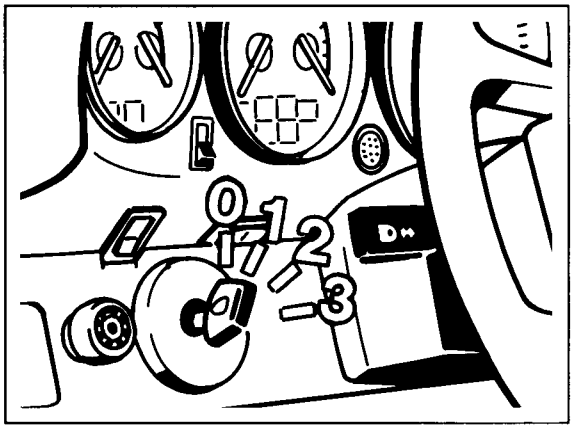
- Notes on removal of the pressure gauge after the tests on Page 47 - 11.

3. Tests

Note

Operation of the pump is regulated by means of the ignition key for testing purposes.

Position 0 = Pump off
Position 1 = Pump on until switched off by the pressure warning switch.



47-10

- In ignition key position 0, plug the electrical plug onto the pump. Locate the pressure gauge in a position where it can be seen.

- For the tests, it is expedient to observe the following sequence:

a. Pressure accumulator - Gas filling pressure

b. Switching points for the brake pressure warning lamp

c. Cut-in and cut-out points of the pump

d. Leak test

- Turn the ignition key to position 1 (pump starts up).

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a. Gas filling pressure of the pressure accumulator.

Turn the ignition key to position 0 at approx. 100 bar.

Press the brake pedal several times and observe the pressure gauge. The pressure accumulator gas filling pressure has been reached at the instant when the pointer of the pressure gauge abruptly falls to 0 bar. Refer to Page 47-12 for nominal values.

Note

Sensitively operate the brake pedal shortly before the gas filling pressure is reached.

b. Checking the switching points for the brake pressure warning lamp.

Pressure build-up:

Start the engine and observe the warning lamp. Immediately turn the ignition key to 0 position at the instant when the warning lamp goes out. Read off the pressure on the pressure gauge.

Pressure reduction:

Produce a system pressure of approx. 140 bar. Disconnect the plug at the pressure pump.
Start the engine
Operate the brake pedal sensitively several times until the warning lamp lights up. Read off the pressure on the pressure gauge. Refer to Page 47 - 12 for nominal values.

c. Checking the switching points of the pressure pump

Cut-out pressure: Turn the ignition key to position 1. The electrical plug must be plugged onto the pressure pump for this. Read off the pressure on the pressure gauge **immediately** after independent pump cut-out.

Cut-in pressure: Turn ignition key to position 1. Wait until the pump switches off independently if appropriate. Press the brake pedal as often as required until the pump starts up. Read off the pressure on the pressure gauge at this instant.
Refer to Page 47-12 for nominal values.

d. Checking the pressure loss of the booster circuit.
Turn the ignition key to position 1. Wait until the pump cuts out independently. Press the brake pedal as often as required until the pump starts up again. After independent cut-out of the pump, turn the ignition key to position 0 and disconnect the electrical plug at the pump. No longer operate the brake pedal. Measure the pressure drop over the course of time. Refer to Page 47 - 12 for permitted values.

Notes

Depressurize the booster circuit before removing the pressure gauge.

On pressure accumulators without mini-measuring connection, bleed the pressure accumulator after removing the pressure gauge. Follow the same procedure here as for bleeding the pressure gauge, Page 47 - 10.

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4. Nominal values / Notes

Nominal values		Notes
Pressure accumulator - Gas filling pressure		Replace pressure accumulator if the gas filling pressure has reached or fallen below the wear limit.
new	80 ± 5 bar	
Wear limit	30 bar	
Switching points of the pressure warning switch		If the actual values deviate from the nominal values, replace the pressure warning switch
Brake pressure warning lamp warning point		
for pressure build-up	up to approx. 115 bar max. up to 133 bar	
for presssure reduction	as from 105 + 2/–5 bar	
Cut-out point of the pump		Read off the pressure immediately after independent cut-out of the pump
at the latest	at approx. 180 bar	
at the earliest	at approx. 160 bar	
Cut-in point of the pump (after pressure reduction)	140 + 5 / – 6 bar	
Freedom from leaks of the booster circuit		Fill the pressure accumulator completely 2 x previously (start the pump running again after 1st cut-out by operating the brake pedal). Then turn the ignition key to position 0 and disconnect the electrical plug at the pump. No longer operate the brake pedal now.
Pressure drop, starting from the cut-out point of the pump (precondition: nominal value is achieved)		External leak: Retighten lines or replace the corresponding parts.
not below 140 bar in 30 minutes		Possible internal leaks:
not below 100 bar in 3 hours		– Brake booster – Valve block for lock control – Pump assembly First check the brake booster. To do this, dismantle the line at the pressure accumulator (in depressurized condition). Close off the pressure accumulator with a mini-measuring connection or suitable bleeder valve. Repeat the test. If appropriate, continue in the same way at the valve block. Then replace the localized/damaged parts and bleed the system.
		Caution: Wear protective goggles and protective gloves when decreasing the pressure via the bleeder valve.

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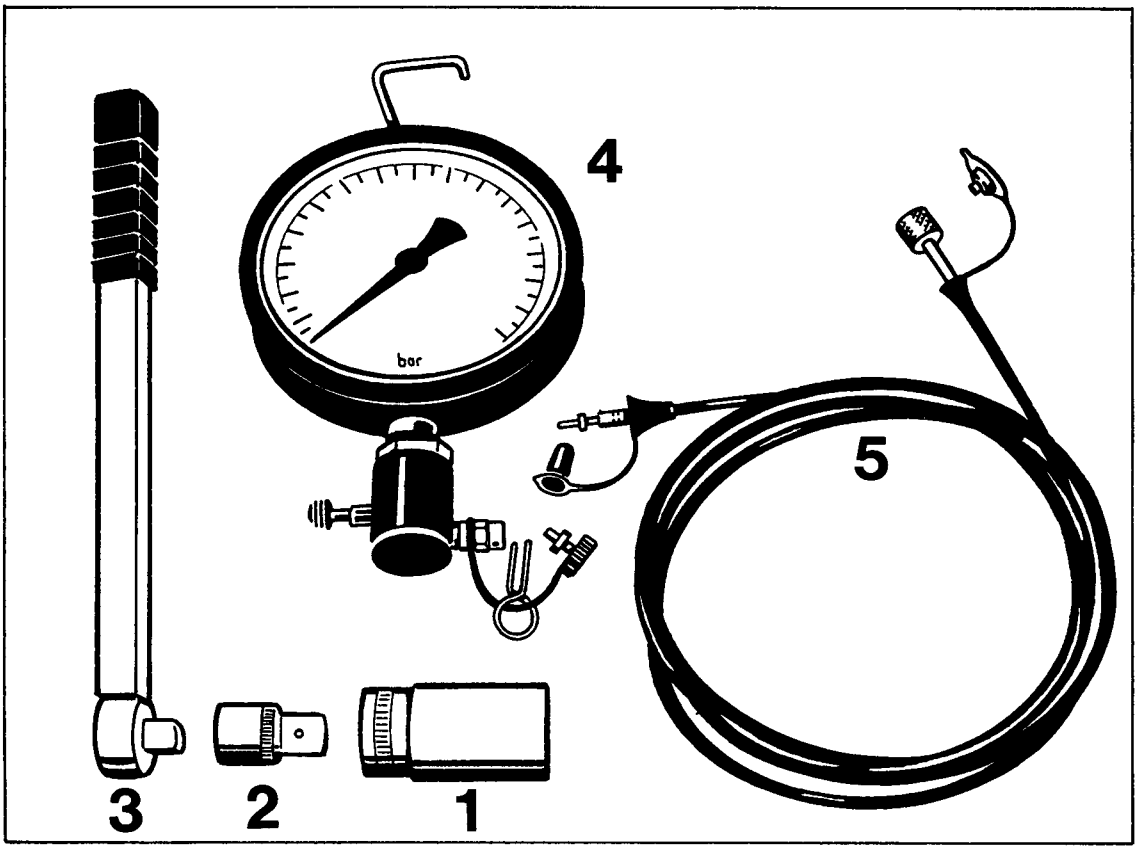
Removing and installing pressure warning switch

Tools



No.	Designation	Special tool	Order number	Explanation
1	Socket wrench insert	9524	000.721.952.40	
2	Reducing adapter from 3/4" to 1/2" or 3/8" according to torque wrench used	–	–	available from automotive trade suppliers; to connect torque wrench with socket wrench insert
3	Self-releasing torque wrench covering torque range between 20 (15) and 30 Nm (22 ftlb)	–	–	available from automotive trade suppliers; Tightening torque for pressure warning switch 26 Nm (19 ftlb)

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Tools

No.	Designation	Special tool	Order number	Explanation
4	Pressure gage	9509	000.721.950.90	For checking leakage and switching point (booster circuit pressure tests) together with measuring line 9509/2 (No. 5) or measuring line 9509/1 (-) on earlier cars without miniature measuring union on pressure reservoir
5	High press. measuring line	9509/2	000.721.950.92	on cars with miniature measuring union on pressure reservoir
–	High press. measuring line	9509/1	000.721.950.91	on cars without miniature measuring union on pressure reservoir, use an M 8 adapter as well (Page 47 - 10).

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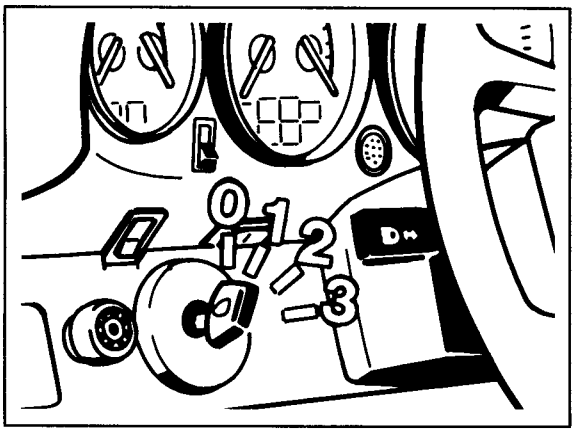
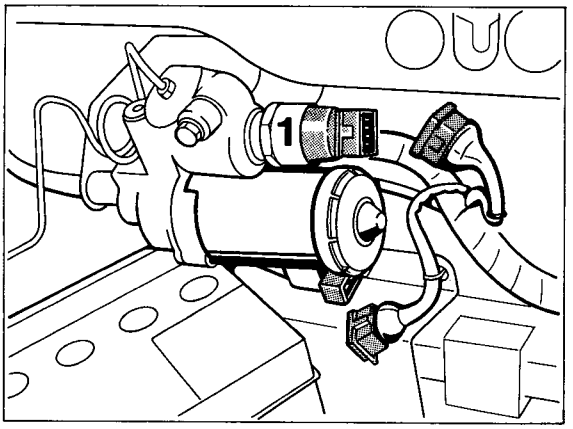
Removing and installing pressure warning switch

Removing

1. With the ignition switch in position 0, pull off both plugs at the pump assembly.



47-10



607-47

2. Evacuate all pressure from the system by pressing the brake pedal down about 25 times. The system is at zero pressure when the brake pedal feels hard as it is pressed.

3. Remove press. warning switch (No. 1 /Drawing 607-47) with special tool 9524. Prevent the pump assembly from turning while loosening the switch.
   Warning: first clean the area round the pressure warning switch and cover it with non-fluffy cleaning cloths to trap the small amount of residual brake fluid which emerges.

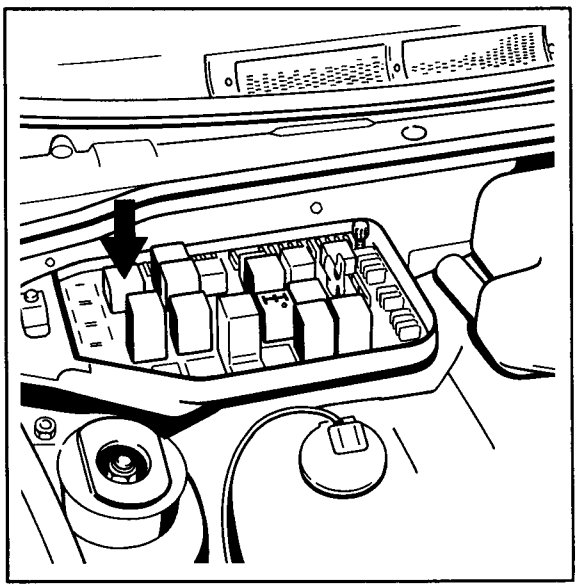
Installing

1. Screw in the pressure warning switch and tighten to a torque of 26 Nm (19 ftlb). Renew the O-ring if necessary. Prevent the pump assembly from turning while tightening.

Note

Wet the sealing ring with brake fluid only. Never use brake cylinder paste. Absolute cleanliness is essential. Use only non-fluffy cleaning cloths.

2. If there is an electrical fault at the pressure warning switch, always exchange the pump relay (R 51 / arrow) as well.



47-15

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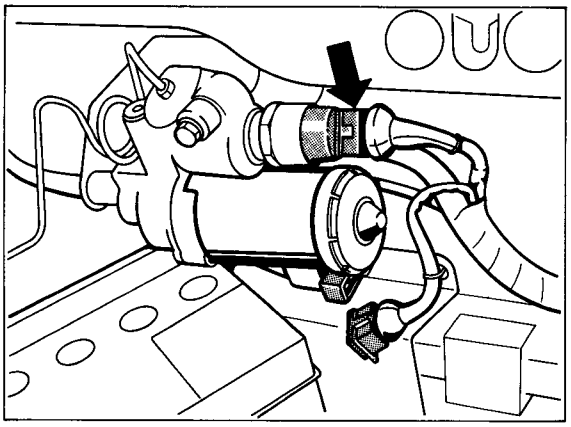
3. Attach plug to pressure warning switch (arrow).



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4. Partly bleed the booster circuit as follows:
Open the bleed valve at the pressure reservoir. Attach the electrical plug to the pump. As soon as brake fluid emerges free from air bubbles, pull off the electrical plug and close the bleed valve.
Next, charge the pressure reservoir completely. To do this, attach the electrical plug. As soon as the pump is heard to switch off, **pull off the electrical plug** and relieve the pressure completely at the pressure reservoir bleed valve. Slowly open the bleed valve and hold the bleed hose firmly.
Warning: a pressure of up to 180 bar is present at the valve.
Wear protective goggles and gloves.

5. Connect pressure gauge SW 9509 to the pressure reservoir and check the switching points of the pressure warning switch and also for leakage in the booster circuit.
The precise working proced. and desired values are stated on Page 47 - 9...47 - 12 (Pressure tests on booster circuit).

Notes

If necessary, top up the brake fluid level at intervals so that the fluid reservoir is not drained completely. The booster circuit must be at zero pressure when connecting and removing the pressure gage.

6. After testing and assembly work has been completed, correct the brake fluid level (Page 47 - 4).

Tightening torques for steering

Location	Thread	Tightening torque Nm (ft.lb.)
Steering gear to cross member	M 8	45 (33)*
Tie rod (balljoint) to steering arm	M 12	65 (48)
Universal joint to steering gear and steering shaft	M 8	23(17)***
Tie rod to balljoint and joint fork (counter nut)	M 14	45 (33)
Tie rod to rack	M 14	70 (51.5)
Steering wheel to steering shaft	M 16	45 (33)
Protective tube to chassis**	M 6	10 (7.5)
Pressure line and return line to steering gear	M 12	20 (15)
Pressure line to servo pump	M 14	30 (22)
Pressure line to pressure line (union nut)	M 14	25 (18.5)

* Replace screws each time they are removed. Only use original spare parts (microencapsulated screws). Threads in cross members, screw theads and washers must be clean and free of grease. Always fit the screws evenly until the fastening clamps are level with the cross member before tightening the screws.

** Break off M 6 and M 8 breakaway screws after carrying out a functional and visual inspection of all relevant components.

*** **Replace setscrews and locknuts each time they are removed.** Tightening torque also applies to cars with airbag (steering wheel with sliding section and universal joint at steering box).

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Replacing the steering in case of accident damage

A. General

Accidents or **driving conditions similar to accidents** may cause various types of damage to steering gears. **If the outside of the steering gear is undamaged,** tracing of damage is sometimes difficult and requires considerable effort. This, however, constitutes an incalculable risk for the safety of the vehicle as it may lead to steering failure.

Due to the fact that a comprehensive check of all steering gear components requires considerable effort and is therefore not normally justifiable or even impossible to be carried out with standard shop equipment, the condition of other components that are easier to be checked must be considered as a **replacement solution.**

The following guidelines (item B) should be observed to decide if the steering gear of an accident vehicle requires replacement or may be used as it is.

B. Assessing the Condition of the Steering System of an Accident Vehicle

The steering gear **may** remain on the car **if all the following conditions** are met:

- No visible damage to front-axle components such as wheels, spring struts, wheel carriers, control arms, steering arms, tie rods, on front-axle crossmembers, on front-axle side members steering shaft as well as body mounts of suspension components.
- No inadmissible increase of torque and no binding or sticking when the steering gear is turned from lock to lock. When turning the steering gear, the front wheels must be off the ground (front axle raised). In addition, the engine must be switched off (power steering pump without drive).
- Admissible tolerances of suspension alignment must not be exceeded.

The steering box **must be replaced or exchanged if any of the following points apply:**

- **Damage to steering gear is visible or can be felt**
- **Burning damage (e.g. bellows of steering burnt)**

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- **Permanent deformation or cracking of:**

  Steering gear mounts

  Tie rods

  Steering arms

  Spring struts (except for 928)

  Wheel carriers

  Control arms

  Front-axle side members

  Front-axle crossmember

If the above criteria are **not** sufficient for a decision, it is recommended to exchange or replace the steering gear.

C. Exceptional regulations / order processing

If the **steering gear replacement proposed** by the shop is refused by the customer or insurance company for financial reasons, an expert or, if this is not possible in foreign contries, the importer should be consulted (to be charged to the refusing party). If a decision is made against the above guidelines, it is recommended to file a note to this effect and have it signed by the expert.

Power steering gears with no visible outside damage that require replacement can be supplied on an exchange basis.

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Inspection and installation work on the rack and pinion power steering

General

Damage to the power steering is caused by a lack of oil in the hydraulic system. Even small leaks can lead to loss of fluid owing to the high oil pressure in the hydraulic circuit, thus resulting in damage to the power-steering pump.

Grunting noises when the steering is locked or foam production in the supply reservoir indicate insufficient oil and/or sucked-in air. However, before the supply reservoir is topped up, any leaks on the suction side must be remedied or the damaged part replaced on the pressure side.

Important note

Rack gear and power pump must not be repaired or dismantled.
The power pump and (for certain versions) the steering gear are available as exchange unit. Refer to our exchange parts catalog.

Power steering pump toothed belt

The toothed belt pretension is not adjustable

Checking the steering system for leaks (visual inspection)

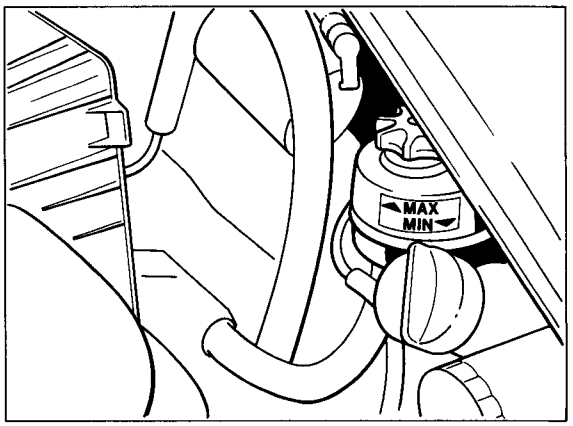
Turn the steering wheel to stop position and hold tight with the engine idling. This builds up the maximum possible line pressure.

In this position, check all line connections for leaks and retighten if necessary.

Perform the test for max. 10 s. If the test takes
longer than this, always pause briefly after approx. 10 s.

Checking the fluid level of the power steering

The supply reservoir with transparent top section is installed on the right in the engine compartment. Check the ATfluid level **(ATF-Dexron II D)** with the engine idling and without steering operation. The correct level is between the min. and max. markings on the reservoir.



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Bleeding the steering system

1. **In order to fill the whole system after installation of new steering assemblies, lines or heavy hydraulic fluid loss, start the engine briefly several times and immediately switch it off again after it has started. During this operation, the fluid level in the supply reservoir falls rapidly. Consequently, the level must constantly be topped up with ATF Dexron II D. The supply reservoir must not be sucked empty.**

2. If the fluid level in the supply reservoir no longer drops when the engine is cranked briefly, start the engine and allow it to run at idling speed.

3. Turn the steering wheel rapidly from one lock to the other several times so that the air can escape from the cylinders. In the limit positions of the piston, do not pull on the steering wheel more than is necessary to turn the steering (unnecessary pressure build-up is initially avoided).

4. Observe the fluid level during this operation. If this still falls, top up until the fluid level remains constant in the fluid reservoir and until no air bubbles rise up in the supply reservoir when the steering wheel is turned:

Note

The oil level in the supply reservoir must not rise more than 10 mm when the engine is switched off.
If the fluid levels deviate from each other by more than 10 mm when the engine is stationary and running, there is still too much air enclosed in the hydraulic fluid.

5. With the engine running at idling speed, produce the correct fluid level (between the min. and max. markings) without operating the steering system.

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Assembling the track rods on the steering gear

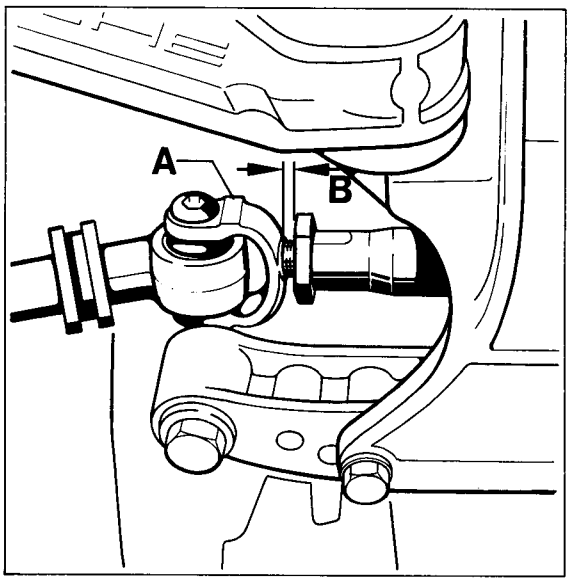
Note

The link fork of the track rod must possess a certain installation position. The track rods are assembled with built-in steering gear. It must be ensured that the rack is not damaged (scores).

1. Screw the track rod into the rack until:

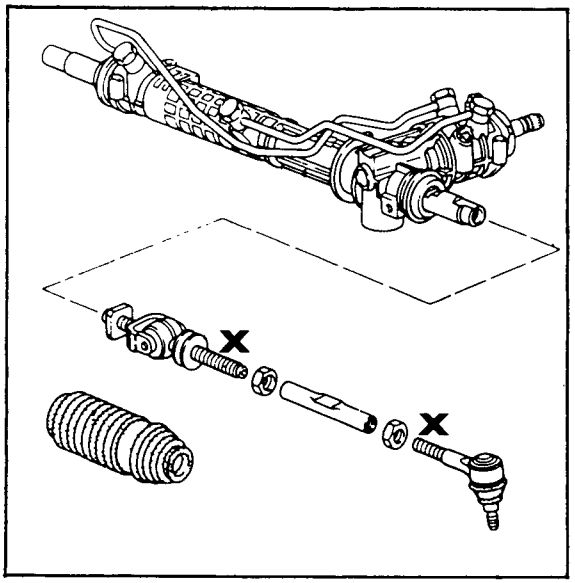
– the link fork (A) is horizontal (±2° deviation from the horizontal in the vehicle permitted).

– and so that the distance (B) between the stop disk and the link fork is approx. 4 - 5 mm. When measuring the distance, the stop disk must rest on the rack. The stop disk simultaneously acts as a locking nut.
Observe usage of stop washer (page 48 - 4).



2. Secure the link fork on the rack in the described position. To do this, tighten the stop disk using the socket spanner insert, special tool 9183.
Tightening torque 70 Nm. **During tightening, hold against tightening force at rack (partially possible only on the left side) and also extend the rack out of the steering gear casing only as far as necessary.**

3. Ensure that approximately the same number of thread turns are screwed into the (X) track rod of the link fork and ball joint. Before fitting the bellows, coat the fully extended end(s) of the steering rack with VW steering gear grease AOF 063 000 04.



48 - 3

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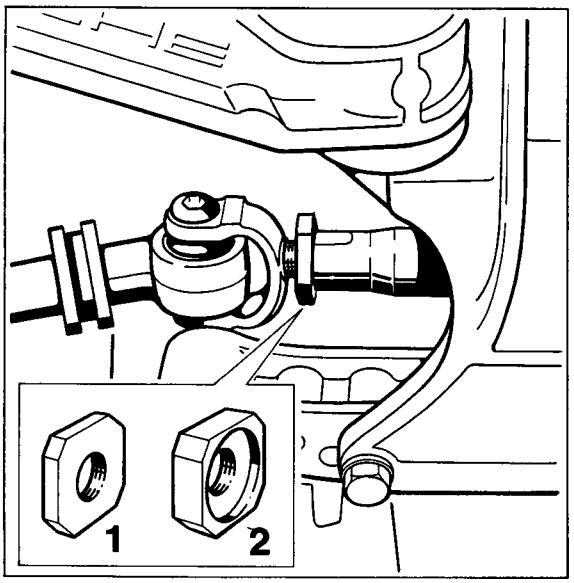
Steering stop limiter

Note

The steering box travel is limited by stop washers. 2 versions are used.

Version 1 = Stop washer ≈6.0 mm thick.
Part No. 964 347 325 00.

Version 2 = Stop washer ≈10 mm thick.
Part No. 964 347 325 02.
Steering rack stroke is smaller than with version 1.



1111-48

Usage

Version 2 (10 mm thick):

- 911 Carrera RS general.
- 911 Carrera 2/4 with 17-inch wheels. Also for 7 J x 16 front wheels.
- For Carrera 2/4 **as of the following VIN (during Model Year 1992):**
  WPO ZZZ 96 Z NS 40 0552 (Coupé RoW)
  WPO AB2 96 8 NS 42 0280 (Coupé USA)
  WPO ZZZ 96 Z NS 43 0124 (Targa RoW)
  WPO BB2 96 6 NS 44 0113 (Targa USA)
  WPO ZZZ 96 Z NS 45 0227 (Conv. RoW)
  WPO CB2 96 5 NS 46 0289 (Conv. USA)

  This allows 16 and 17 inch wheels to be fitted to the Carrera 2/4 without having to perform additional service work on the steering stop.

Version 1 (6 mm dick):

- 911 Turbo 91 → and 911 Turbo Look.
- 911 Carrera 2/4 with 6 J x 16 front wheels, up to the above modifications applied during Model Year 1992.

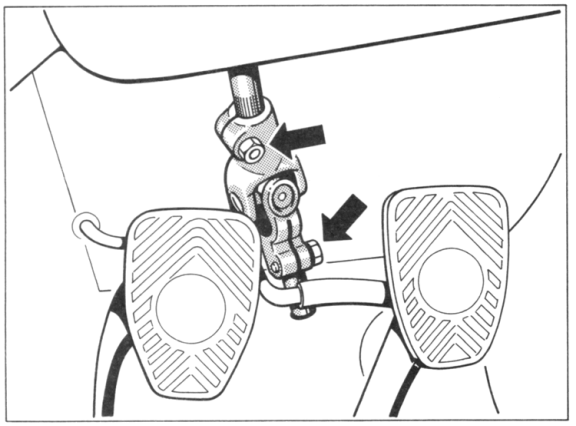
Removing and installing steering gear

Removal

1. Separate universal joint (steering shaft) from steering gear. To do so, remove floorboard of pedal cluster. Undo both clamping screws and push joint upwards.

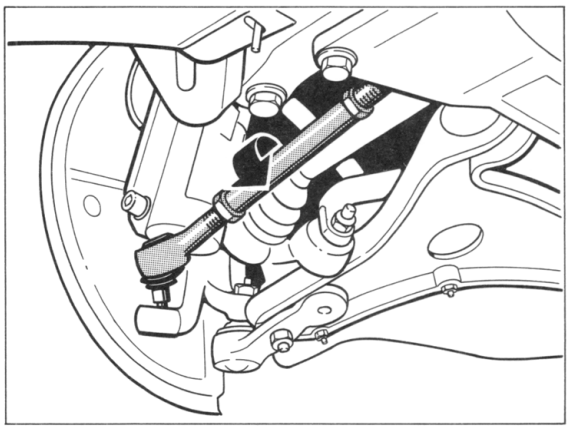
Note

On **airbag vehicles**, the steering wheel must be located with the road wheels in straight-ahead position. If this requirement is not observed, the airbag contact unit must brought into the **center position after** the steering gear has been fitted (p. 48 - 8).
Airbag vehicles are fitted with a sliding joint. This way only one clamping screw (dowel screw) is provided.



2. Remove underside panel.

3. Press tie-rod ball joint off the steering arm. Use a suitable puller, e.g. Nexus 168-1. Start by loosening the inner lock nut of the tie-rod adjuster. Turn tie-rod along with ball joint to the rear (arrow). Extend ball joint. Repeat procedure on the other side.

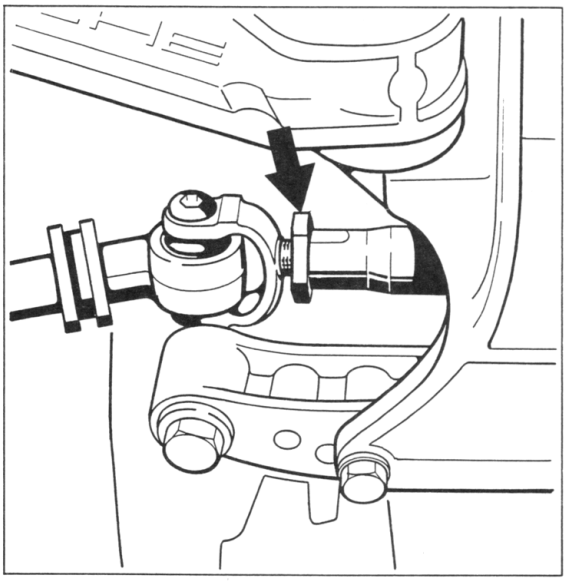


859-40

4. Remove right and left-hand tie-rod after the lock nut / stop washer (arrow) has been undone.

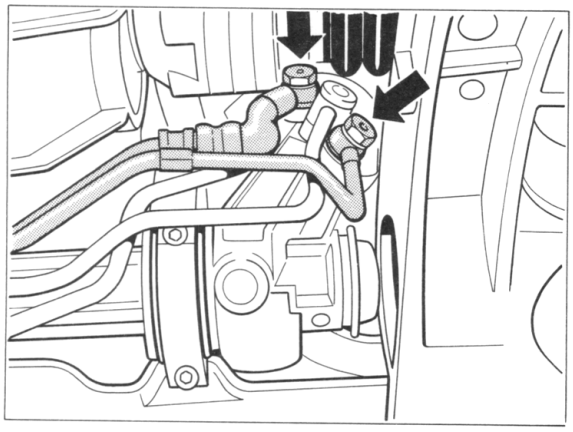
Note

Make sure the steering rack is not damaged (score marks). This is also important when removing and installing the steering gear. Use protective caps or a rubber or plastic hose for protection.



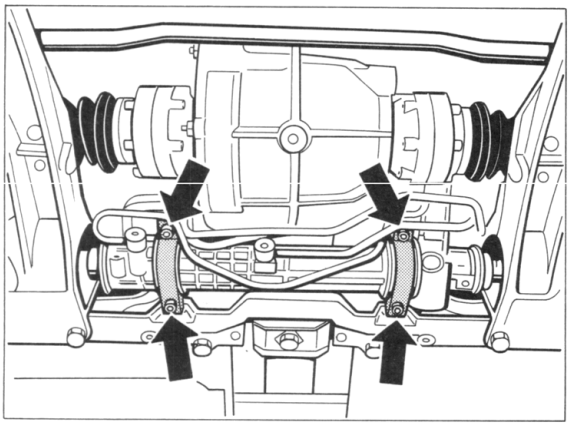
370/1-48

5. Undo feed and return lines of steering gear. Block lines or place receptacle below lines. If required, unclip power steering line from retainer.



1089-48

6. Undo steering gear mounting bolts.



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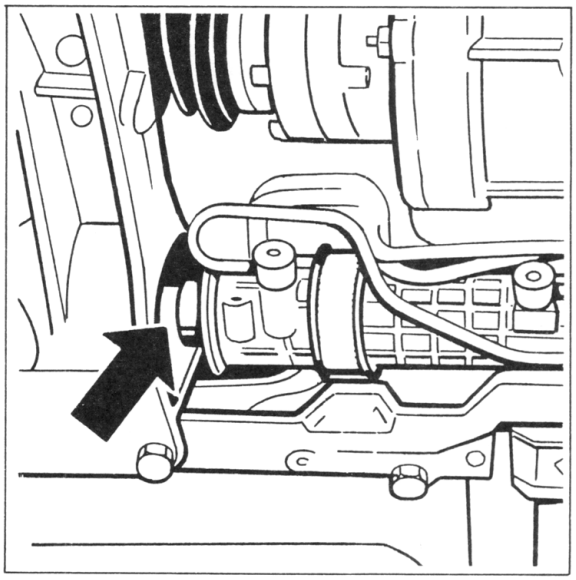
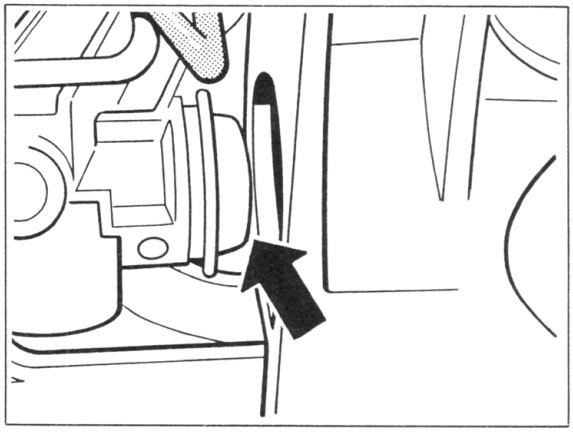
7. Extend steering gear as follows: Rack on **right-hand** side is fully retracted into steering gear housing (arrow). Lower steering gear on **right-hand** side.



1091-48

Then retract steering rack on left-hand side fully into steering gear housing (arrow), pulling or pushing (as required) on face of steering rack (take care not to damage the steering rack). Extend steering gear in rotary piston / rotary valve area and take out towards bottom.



1092-48

Installation

Install in reverse order.
Be sure to observe the following points:

- **Replace steering gear mounting bolts and dowel screw(s) of the steering shaft with new parts after each removal operation.**
  Clean threaded bores for steering gear mounts with compressed air.

- **Make sure that the steering rack is not damaged (score marks).**

- With the rack fully extended, coat steering rack with VW steering gear grease AOF 063 000 04.

- When replacing the steering gear, assemble the rubber mounts and mounting clamps with Omnis 32 (Texaco) before fitting the gear into the vehicle.

- Push universal joint (steering shaft) into correct position — with steering wheel, steering box and contact unit (spiral spring) of airbag vehicles in center position.
  Steering gear fastening bolts should only be screwed on lightly (to facilitate assembly).
  Observe notes for airbag vehicles (p. 48 - 7 / 48 - 8).

- After having tightened the steering gear mounting screws, assemble the tie-rods with the steering gear, observing the correct position (page 48 - 3).

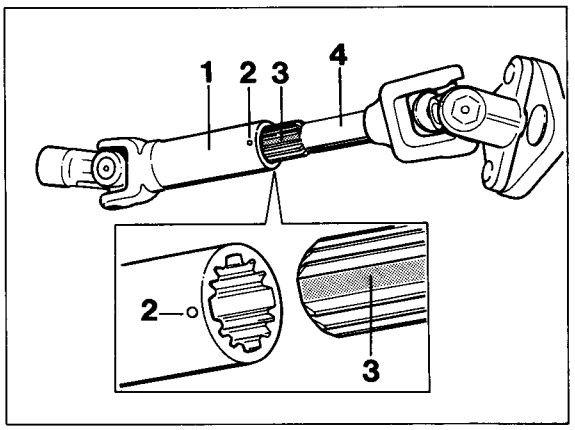
- After having reconnected the pressure lines, fill steering hydraulics and bleed the steering gear (page 48 - 2).

- Tighten all nuts and bolts to the specified torque.

- Check toe-in and adjust if required.

Notes for airbag vehicles

1. If slider No. 1 has been pulled of the steering shaft No. 4, the roll pin No. 2 must face the tooth cutout (No. 3) when the components are reassembled.



1396-48

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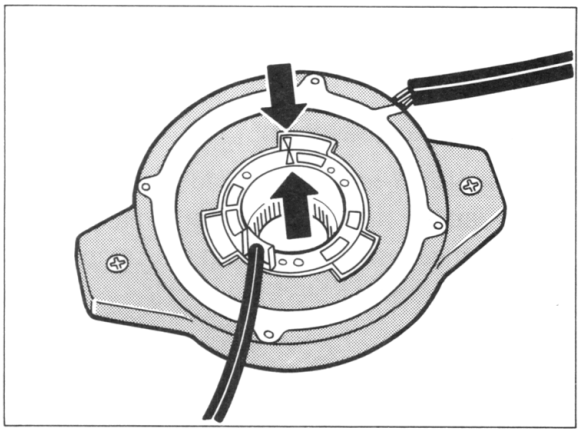
2. If the steering wheel has **not been located** before the steering gear was removed, the **correct position of the contact unit** (spiral spring) may have been lost.
   In this case, set the contact unit to the center position (approx. 4 1/2 turns from left-hand or right-hand full lock) with the front wheels in straight-ahead position (steering shaft fitted to steering gear). The precise center position is indicated by two arrows.



280-68

A new contact unit will be supplied locked in the center position. The lock is not removed until the contact unit is fitted.

Removing and installing steering/ignition lock

Removal

1. Disconnect battery.

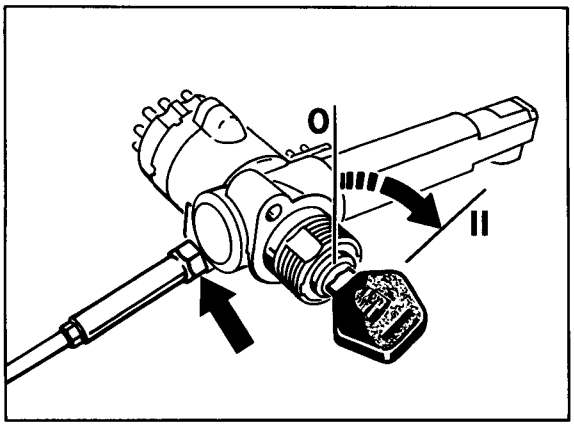
2. Remove radio, heater control unit, left-hand air vent and knee guard.

3. Remove steering wheel. Observe safety precautions for vehicles fitted with airbag (Rep. Group 68). For removal and fitting of airbag steering wheel, refer to page 68 - 3.

4. On vehicles with keylock, remove bowden cable from ignition lock.
   Prior to removal, turn ignition key to pos. "II" (Ignition on).
   Then unscrew bowden cable from steering/ignition lock (arrow).

Note

The steering/ignition lock must at all times be set to position "II". If it is set to any other position, the steering/ignition lock and the keylock bowden cable will be damaged.



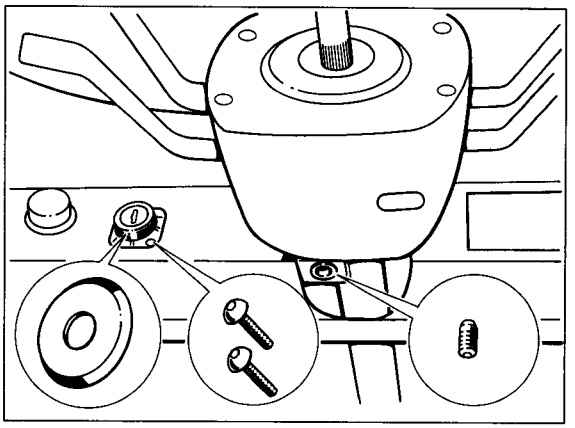
1068-37

5. Unscrew escutcheon. Drill out both 6 mm shear bolts and the 8 mm shear bolt that holds the steering/ignition lock to the steering outer tube.

Note

To drill out 8 mm shear bolt, proceed as follows:
Punch bolt off-center (steering wheel side) across cutout for steering shaft harness in bottom of instrument panel.

Pre-drill with a 4 mm dia. drill bit (min. length 120 mm) across the above aperture. Finish by drilling shear bolt from threaded bushing (pressed-in bushing) with 7-8 mm dia. drill bit (longer than 120 mm).



1095-48

6. Pull connector off ignition/starter switch and buzzer contact.
   Pull out steering/ignition lock.

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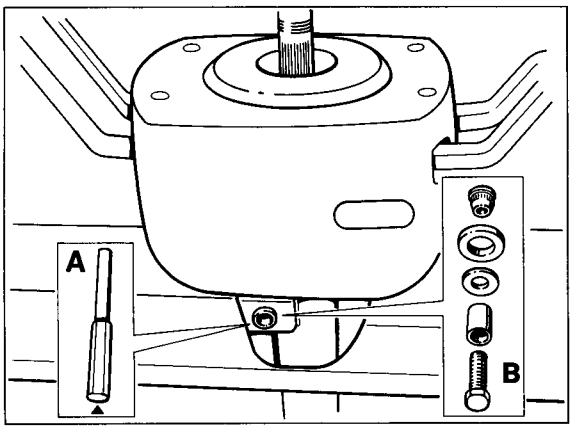
Replacing the threaded bushing

A damaged threaded bushing may be replaced as follows:

Push out threaded bushing with a suitable drift (A).

Pull in new threaded bushing with the aid of suitable washers and a corresponding spacer sleeve (B).

When pulling the bushing in, remember that the threaded bushing protrudes from the steering outer tube. (Inner dia. of washer is larger than outer dia. of bushing). Center washer correctly before pulling bushing in.



1096-48

Installation

1. Place steering/ignition lock into vehicle with lock pin disengaged (lock position "II").

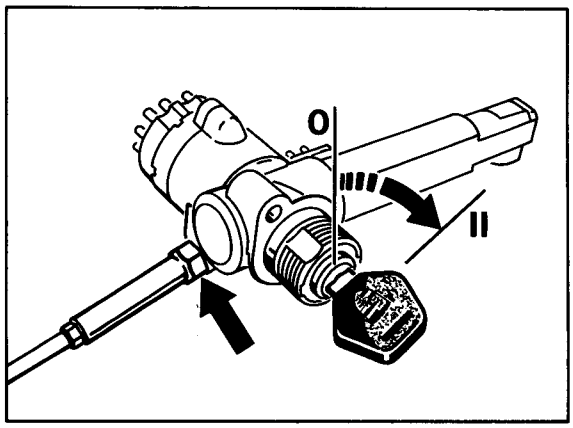
2. Turn shear bolts into place but do not shear off yet. Fit steering wheel.

3. Fit connector of ignition/starter switch and buzzer contact.

4. On keylock vehicles, fit bowden cable with steering/ignition lock set to position "II". **Then** set selctor lever to "P" and turn ignition lock to "0" afterwards.

Note

If the steering/ignition lock cannot be turned to "0", the bowden cable must be readjusted (refer to Rep. Group 37).



1068-37

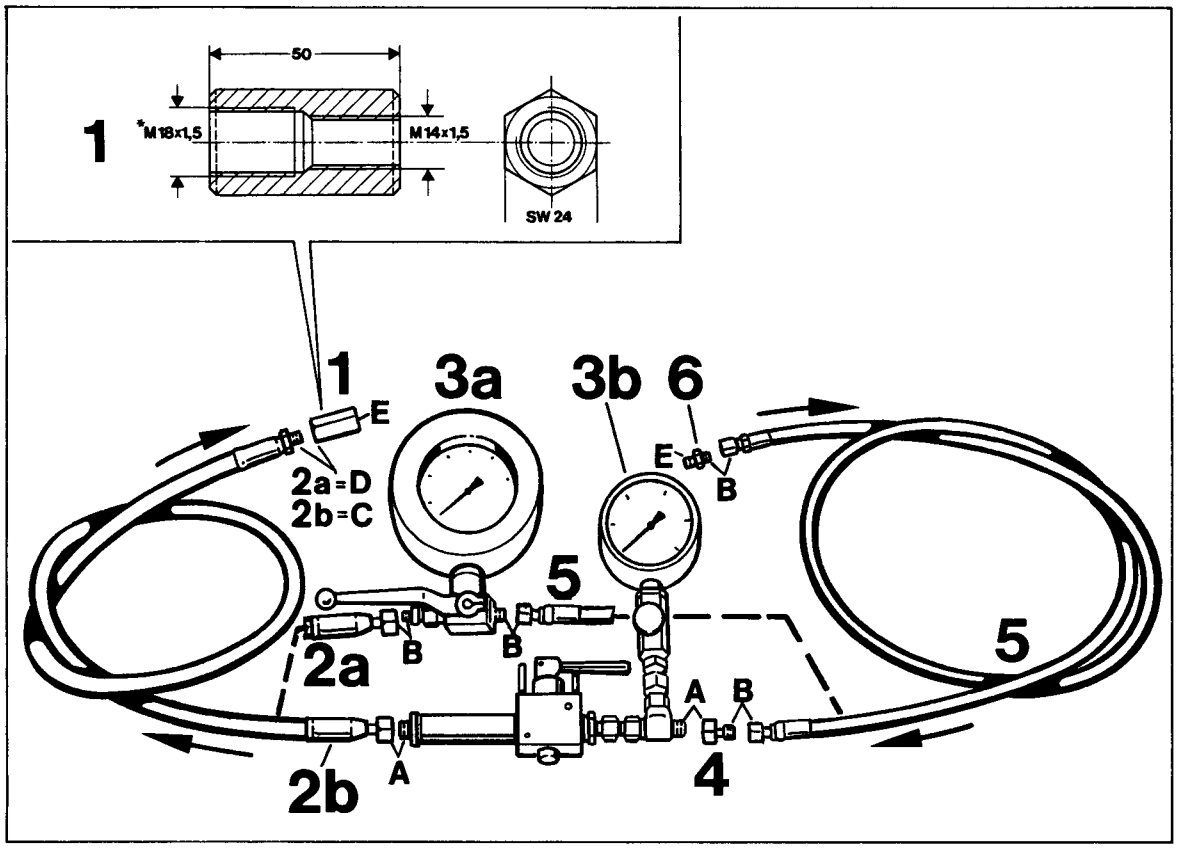
5. Check operation of steering/ignition lock (operation of lock pin) and operation of keylock. Shear off bolts only if this check is o.k.

Checking hydraulic operation of steering system (pressure measurement)

Tools

Note

All parts (Nos. 1 to 6) may be used **as on the 944/928**. The pressure gauge is connected to the power pump (between power pump and pressure line) **as on the 944/968**.
Flange **No. 6 connects to the power pump.** Adapter No. 1 connects to the pressure line.
If the old **pressure gauge No. 3b** is used (see below), make sure the high-pressure hoses **No. 2b and No. 5 are connected to the pressure gauge in the correct positions.**
The high-pressure hoses, however, may be connected **in any position on pressure gauge No. 3a.**



A = M18 x 1.5 with head seal
B = M16 x 1.5 with head seal
C = M18 x 1.5 flat sealing face with sealing ring
D = M16 x 1.5 flat sealing face with sealing ring
E = M14 x 1.5 flat sealing face with sealing ring

* Threads M 18 x 1.5 **or** M 16 x 1.5, depending on pressure gauge type (refer to tool list on page 48 - 12)

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No.	Designation	Special Tool	Order number	Explanation
1	Adapter (2 models / specific for gauge type)			**for pressure gauge 3 b:** Shop-made tool, refer to drawing (p. 48 - 11) **for pressure gauge 3 a:** Shop-made tool, differing from drawing. Threads are **not** M 18 x 1.5 (for pressure gauge 3b) **but M 16 x 1.5**
2a	High-pressure hose to 200 bar, 1.5 m long **for pressure gauge 3a**			commercially available, **M 16** x 1.5 with head seal on one end and **M 16** x 1.5 flat sealing face with sealing ring on the other end
2b	High-pressure hose to 200 bar, 1.5 m long **for pressure gauge 3b**			commercially available, **M 18** x 1.5 with head seal on one end and **M 18** x 1.5 flat sealing face with sealing ring on the other end
3a	Pressure gauge 0 - 160 bar	V.A.G.1402		Order No. Z 401 103 WE from Volkswagenwerk AG Wolfsburg KD-Gerätevertrieb VK35 Phone 05361 / 9-26479 , Fax 05361 / 9 - 21771
3b	Pressure gauge 0 - 250 bar, **old version no longer available**			
4	Reducer **(not required for pressure gauge 3a)**			commercially available, M 18 x 1.5 to M 16 x 1.5 with head seal

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No.	Designation	Special Tool	Order number	Explanation
5	High-pressure hose to 200 bar 2.0 m long			commercially available M 16 x 1.5 with head seal at both ends
6	Flange			commercially available, M 16 x 1.5 with head seal at one end and M 14 x 1.5 flat sealing face at the other end

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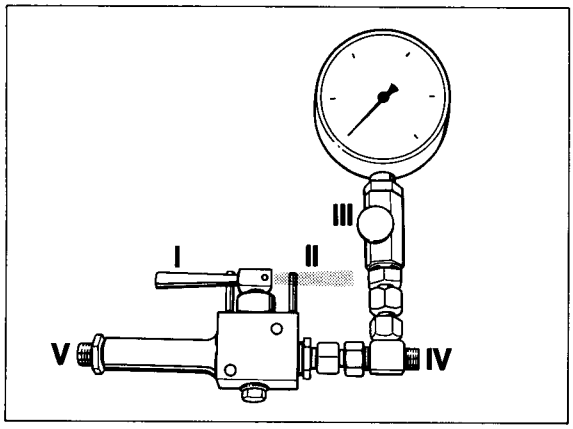
Checking hydraulic operation of steering system (pressure measurement)

General

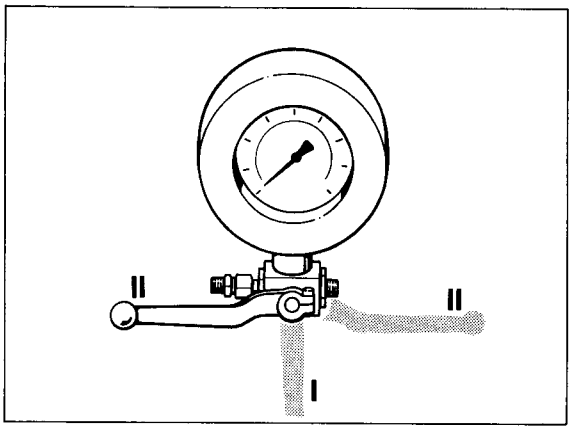
The tester (pressure gauge) is connected between the power pump and the press. line. If the **old press. gauge is used**, pay attention to the correct **installation position**. For better understanding of the below descr., the conn. and lever positions have been identified.

Old version



1394-48

V.A.G. 1402



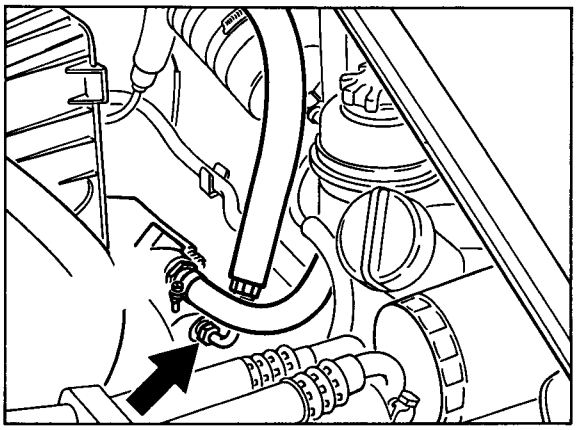
1395-48

I - Shutoff valve open
II - Shutoff valve closed
III - Damping orifice
IV - from power pump
V - to pressure line

Fitting the pressure gauge

1. Take off air cleaner cover complete with filter element.

2. Undo pressure line at power pump.
   Catch hydraulic fluid in a container (do not reuse).



455A-48

3. Screw high-pressure hose No. 5 with flange No. 6 to power pump (required seal: 14 x 18).

4. Fit high-pressure hose **No. 2a or 2b** (1.5 m long) to pressure line, using the banjo bolt and adapter No. 1.
   Required seals: 2 x 14 x 18 and 1 x 18 x 22 or 1 x 16 x 20.

5. Install pressure gauge between high-pressure hoses and place on a support (e.g. tool box).
   A helper is required to read off the pressures.
   Make sure the hose section of the pressure line is not kinked. In addition, the tester hose must be kept at a safe distance from the belts and pulleys.

Note

Use reducer No. 4 for the older pressure gauge model **(No. 3b)** and fit high-pressure hose **No. 5** to **connection side IV of** pressure gauge.

6. Open shutoff valve at pressure gauge (lever position I), top up reservoir and bleed steering system (page 48 - 2).

Checking supply pressure of power pump

1. With the engine at idle, close shutoff valve (lever position II) and read off pressure.
   Specification: 100 to 110 bar. Open shutoff valve again immediately.

Note

To avoid wear, do not leave the shutoff valve closed for more than **5 seconds**. On **pressure gauge type 3a,** select lever position **"II right or II left",** depending on how the high-pressure hoses have been connected to the pressure gauge.
No reading is obtained if lever position II is incorrect.

2. If the specified value is not reached or if it is exceeded, the power pump must be replaced.

Checking system pressure

1. Run engine at idle. The shutoff valve must be open (lever position I).

2. Turn steering wheel to left-hand and right-hand full lock and read off fluid pressure on pressure gauge.
   Specification: 100 - 110 bar.
   Requirements: Supply pressure of power pump must be o.k.
   It is not sufficient, however, if only the steering lock limiter becomes effective. The return force of the rotary piston valve or rotary slide valve must also be overcome. Steering wheel force is aprox. 100 N / 10 kp.

3. If the specified value is not reached on the left-hand or right-hand side (excessive drain flow), replace the steering gear assembly.

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Carrera 2

Printed in Germany - XXII, 1995

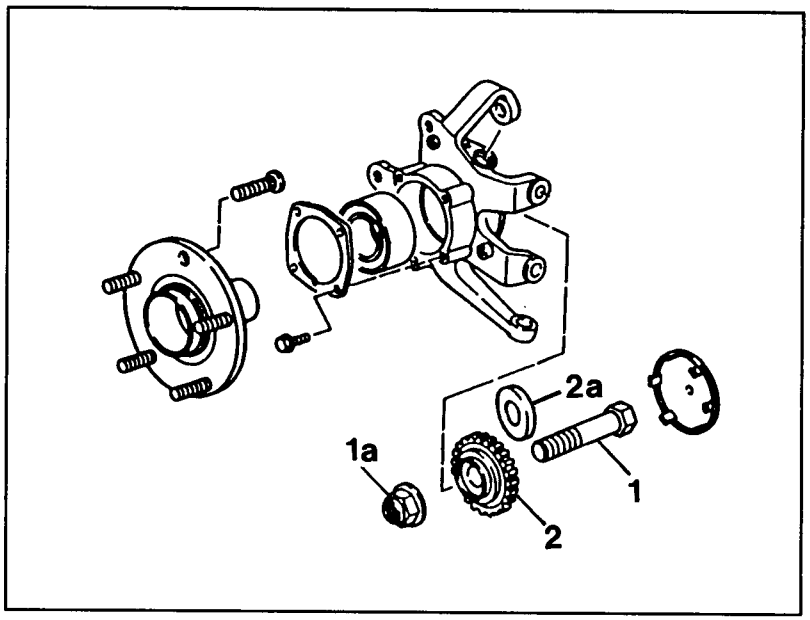
Wheel hub to wheel bearing screw connection

General

In the course of the 1992 Model Year, the wheel hub to wheel bearing screw connection was modified on the 911 Carrera 2, 911 Turbo-Look, America Roadster and 911 Turbo.
Initially, a 4 mm washer (2a) was added between the tensioning shim (2) and the bolt head (1).

At a later date, the tensioning shim (2) was reinforced. The washer (2a) was omitted again as of this date.

For detailed introduction dates, please refer to the Technical Information, Group 4.

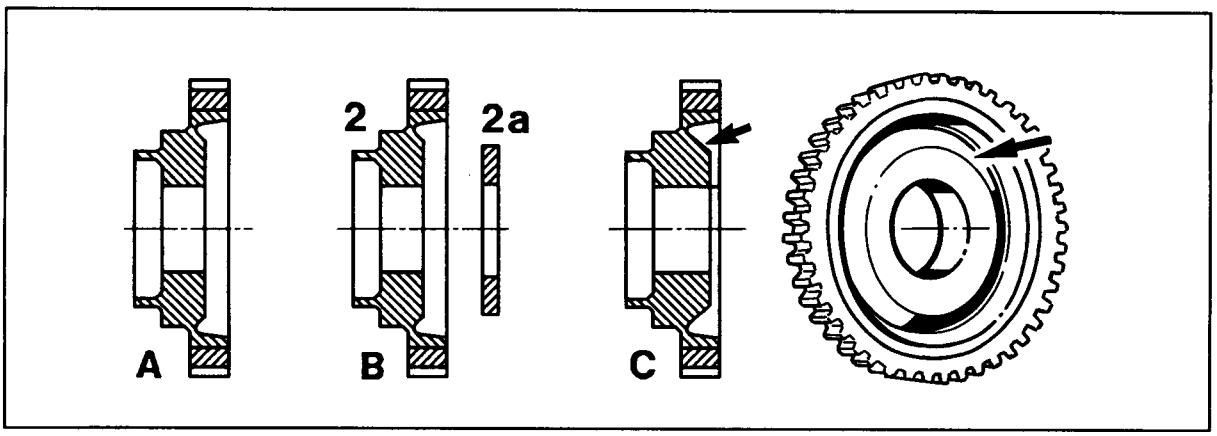


1326-40

1 - Bolt
1a - Nut
2 - Tensioning shim with ABS ring gear
2a - Washer

Versions of screw connection

A = Initial version
B = Modified version (as initial version, with additional 4 mm washer)
C = New version (reinforced, without washer)



2 - Tensioning shim
2a - Washer

Assembly notes

- Only the **reinforced** tensioning shim with ABS ring gear is now supplied by the spare parts department.

- This reinforced tensioning shim is also retroactively applicable if repairs are required.

- **The additional washer must not be fitted with the reinforced tensioning shim!**
  The washer is not supplied for spares purposes. If the washer is faulty or missing, fit the **reinforced tensioning shim** instead.

- The tightening torque for the wheel hub to wheel bearing screw connection of the front axle is **460 Nm.** This value is applicable to all modification levels (A / B / C).

Wheel hub to wheel bearing bolt union on the Carrera RS

General

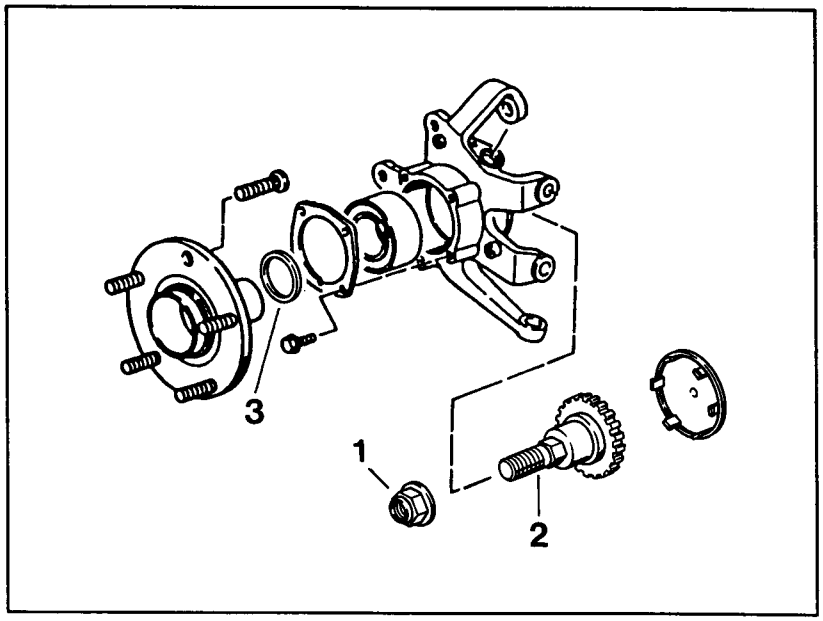
On the 911 Carrera RS, both the tensioning stud (No. 2) and the wheel hub are made of aluminum. A spacer is therefore inserted between the wheel bearing inner race (on the outside) and the wheel hub.
The following assembling instructions should be adhered to during all removal and installing operations.

Assembly notes

Undo and tighten the lock nut (No. 1) with the vehicle on its wheels. Actuate the brakes at the same time. When undoing the tensioning stud, raise the vehicle immediately after undoing the lock nut. When fitting the tensioning nut, screw the lock nut in place before lowering the vehicle onto its wheels. If this precaution is not observed, the wheel bearing may be damaged.
To keep the assembly from turning when undoing the lock nut or when fitting the tensioning stud, a 3/4 inch square is provided on the tensioning stud.

Replace the spacer and the lock nut when repairs are required. Check the tensioning stud visually and replace it if required.

The tightening torque of the wheel hub to wheel bearing bolt union is **460 Nm (339 ftlb.).**



2048-40

1 - Lock nut
2 - Tensioning stud
3 - Spacer ring

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Technical Data

The technical data are valid for the 911 Carrera 2, 911 Speedster and 911 Carrera RS America.

Designation		Remarks, Specification	Wear Limits
Service brake (foot-operated)		Hydraulic dual circuit brake system with front/rear axle brake circuit division. Vacuum brake booster, inboard vented brake discs with four-piston fixed calipers at the front axle and two-piston fixed calipers or four-piston fixed caliper at the rear axle. ABS standard.	
Brake booster (vacuum)		8 inches	
Boosting factor		3.0	
Brake master cylinder	Ø front	20.64 mm	
Filling stage (Quickfill)	Ø rear	20.64 mm	
	Stroke	20/16 mm	
Brake force regulator			
Switchover pressure reducing factor			
for two-piston **rear-axle** brake caliper		45 bar - 0.46	
for four-piston **rear-axle** brake caliper		55 bar - 0.46	
Brake disc Ø front		298 mm	
rear		299 mm	
Effective brake disc Ø front		248 mm	
rear: two-piston fixed caliper		252 mm	
rear: four-piston fixed caliper		246 mm	
Piston Ø in brake caliper			
front		2 x 40 + 2 x 36 mm	
rear: two-piston fixed caliper		2 x 44 mm	
rear: four-piston fixed caliper		2 x 30 + 2 x 28 mm	
Brake pad area			
front		172 cm^2	
rear: two-piston fixed caliper		112 cm^2	
rear: four-piston fixed caliper		172 cm^2	

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Designation		Remarks, Specification	Wear Limits
Total brake pad area with			
two-piston fixed caliper		284 cm^2	
four-piston fixed caliper		344 cm^2	
Pad thickness	front	approx. 12 mm	2 mm
	rear	approx. 10 mm for 4-piston fixed caliper	2 mm
Brake disc thickness (new)	front	28 mm	
	rear	24 mm	
Brake discs			
Minimum thickness* after machining			
	front	26.6 mm	26.0 mm
	rear	22.6 mm	22.0 mm
Max. brake disc thickness tolerance		0.02 mm	
Max. brake disc lateral runout		0.05 mm	
Lateral runout of wheel hub max.		0.05 mm	
Max. lateral runout of brake disc in installed state		0.1 mm	
Max. peak-to-valley surface finish after machining		0.006 mm	
Push rod play (measured on brake pedal plate)		approx. 8 mm	
Parking brake		mechanical via brake drums on both rear wheels	
Brake drum Ø		180 mm	181 mm
Brake shoe width		25 mm	
Brake liner thicknesss		4.5 mm	2 mm

* Brake discs may only be machined symmetrically, i. e. uniformly on both sides.

Technical data

The technical data are valid for the 911 Carrera 2 Turbo-Look, 911 America Roadster and 911 Carrera RS.
TL = Carrera 2 Turbo-Look. Carrera 2 Turbo-Look specif. are also valid for the 911 America Roadster.
RS = 911 Carrera RS. For the 911 Carrera RS America, the values from p. 46-0101/0102 apply.

Designation		Remarks, dimensions	Wear limit
Service brake (foot brake)		Hydraulic dual-circuit brake system with front axle/ rear axle brake circuit division. Hydraulic brake booster, internally vented and drilled brake discs with four-piston fixed caliper on front and rear axle. ABS standard.	
Brake booster		hydraulic	
Boost factor	TL	4.8	
	RS	3.6	
Brake master cylinder	Ø front	23.81 mm (**RS** 25.4 mm)	
	Ø rear	23.81 mm (**RS** 25.4 mm)	
	stroke	20/12 mm	
Brake power controller			
Switchover press. / red. factor	TL	60 bar - 0.46	
	RS	55 bar - 0.46	
Brake disc Ø	front	322 mm	
	rear	299 mm	
Effective brake disc Ø	front	268 mm	
	rear TL	249 mm	
	rear RS	246 mm	
Piston Ø in caliper	front	2 x 44 + 2 x 36 mm	
	rear	2 x 34 + 2 x 30 mm	
Brake pad area	front	250 sq.cm	
	rear	172 sq.cm	

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Designation		Remarks, dimensions	Wear limit
Total brake pad area		422 sq.cm	
Pad thickness	front	approx. 12 mm	2 mm
	rear	approx. 12 mm	2 mm
Brake disc thickness, new	front	32 mm	
	rear TL	28 mm	
	rear RS	24 mm	
Minimum brake disc thickness* after machining	front	30.6 mm	30.0 mm
	rear TL	26.6 mm	26.0 mm
	rear RS	22.6 mm	22.0 mm
Thickness tolerance of brake disc, max.		0.02 mm	
Lateral runout of brake disc, max.		0.05 mm	
Lateral runout of wheel hub, max.		0.05 mm	
Lateral runout of brake disc when fitted, max.		0.1 mm	
Surface roughness after machining, max.		0.006 mm	
Pushrod clearance (measured at brake pedal plate)		approx. 8 mm	
Parking brake (handbrake)		mechanical drum brake, acting on both rear wheels	
Handbrake drum Ø		180 mm	181 mm
Brake shoe width		25 mm	
Brake lining thickness		4.5 mm	2 mm

* The brake disc must only be machined symmetrically, i.e. by an equal amount on both sides.

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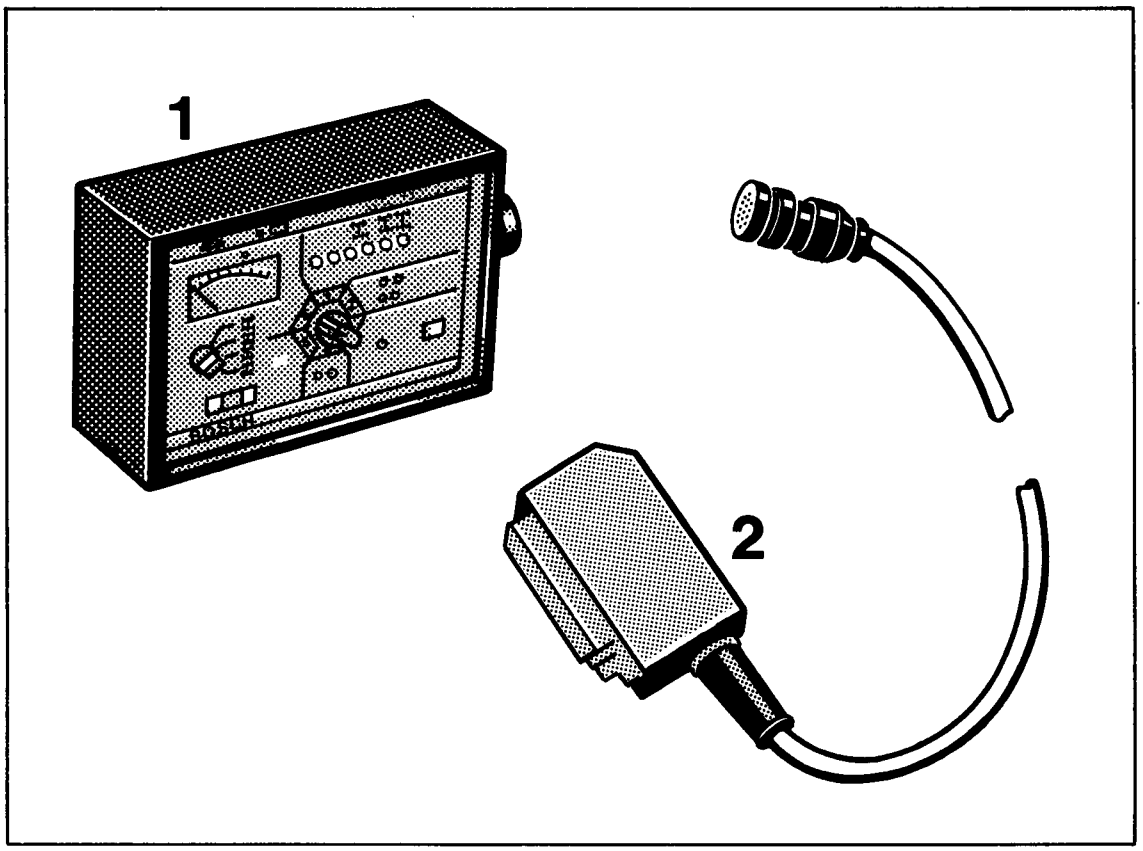
ABS test on 911 Carrera 2 using ABS 2-LED tester

Important notes on the 911 Carrera 2 ABS

1. Whenever work is carried out on the hydraulic unit, speed sensors or pipes, or any assemblies are exchanged, for example during accident repairs, **a functional check with the ABS tester must always be performed.**
   This is to prevent electrical wiring or hydraulic lines from being connected up wrongly, and to ensure that the hydraulic unit operates correctly.

Tools



Printed in Germany – X, 1990

Tools

No.	Designation	Special tool	Order number	Explanation
1	ABS 2-LED tester		KDAS 0003	**Manufactured by:** Robert Bosch GmbH, Dept. KH/VKD 3 P.O. Box 41 09 60 7500 Karlsruhe 41 Federal Republic of Germany Telephone: 0721/4009-1 Telex: 78 26 663 **Supplier:** Authorized dealer or parts distributor
2	35-pole ABS 2-LED adapter cable			Included with ABS 2-LED tester

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Quickfill brake master cylinder

Assembly notes

Pull out and engage the Quickfill brake master cylinder in a straight line during dismantling and assembly, respectively. If this precaution is not observed the brake booster may be damaged.

Chainging the brake fluid / bleeding the brakes

Notes

The filling stage of the brake unit may cause air to remain trapped in the hydraulic brake system without this being felt directly at the brake pedal. **For this reason, the specified bleeding sequence must be strictly adhered to.**

Use only new DOT 4 brake fluid.
Observe change intervals and brake fluid grade.
Total brake fluid quantity for fluid change: **approx. 1 liter.**

On vehicles up to MY '92, the brake fluid must be replaced **every 2 years** as a minimum.

As of MY '93, the brake fluid change interval has been increased to **3 years** - along with the use of special DOT 4 brake fluid.

The 3-year change interval is valid as of MY '93, but only in conjunction with the use of the special Porsche brake fluid. The brake fluid is available under Part No. 000.043.202.04.
Container contents: 5 liters (as of May, 1992).

This special brake fluid may also be used on pre-MY '93 vehicles. However, the **two-year** fluid change interval will remain valid for those vehicles.

Brake fluid

The new brake fluid - Part No. 000.043.202.04 - offers superior properties. Compared to the brake fluid specified previously, its main features are **further reduction of water absorption and increased wet and dry boiling points.**
Notes on water absorption: Water contents of only 2 % in the brake fluid will cause the boiling point to drop by approx. 60°C.

As of MY '93, only the new brake fluid must be used when topping up the reservoir. Any mixture of former brake fluid with the new brake fluid causes the safety margin of the fluid to be narrowed down unnecessarily. Both the former and the new brake fluid are of amber color.

Procedure for bleeding and changing the fluid

1. Top up reservoir with fresh brake fluid up to upper edge. **Connect bleeder unit to reservoir. Block overflow (vent) hose using a hose clamp.** Switch on bleeder unit. Bleeding pressure approx. 2 bar.

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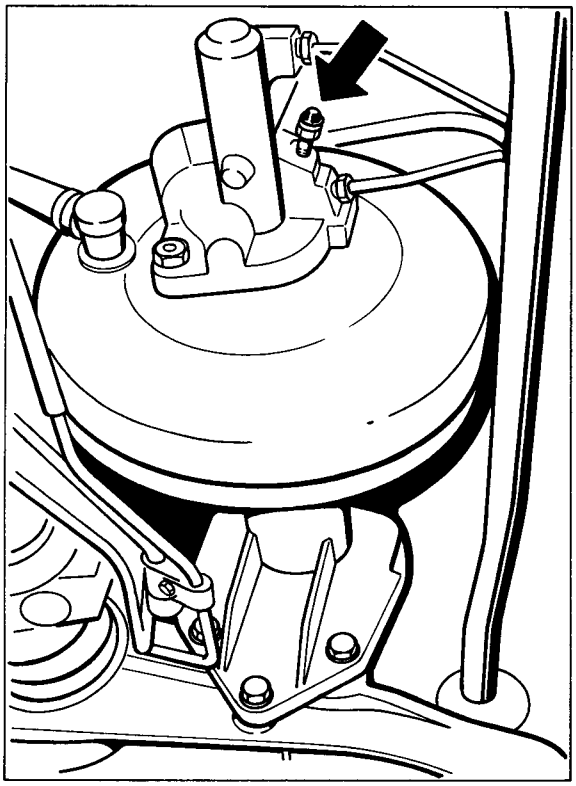
2. The Quickfill brake master cylinder is fitted with a bleeder valve (arrow) for bleeding the filling chamber.
   Start by bleeding the filling chamber.
   Caution: As opposed to other bleeding operations, the brake pedal must be actuated with sufficient force at least 4 times when the respective bleeder valves are opened. It is important to release the pedal fully before and after it is actuated and to depress it fully to the stop.



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3. Proceed by bleeding or changing the brake fluid, respectively, at the calipers (no specific sequence needs to be observed).
   Open each bleeder valve only until clear, bubble-free brake fluid escapes or until the respective fluid change quantity per brake caliper is reached.
   Make sure that both bleeder valves of the four-piston fixed calipers are bled and that the brake pedal is actuated with sufficient force 4 times for each of the valves **(as described under para. 2. above)**.

4. When changing the brake fluid, also drain some brake fluid at the bleeder valve of the clutch slave cylinder.

5. **Switch off and disconnect bleeder.**
   Remove hose clip from overflow hose (vent). If required, top up brake fluid level.

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